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OF

PACIFIC COAST GEOGRAPHERS

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ASSOCIATION OF
PACIFIC COAST GEOGRAPHERS

Volume 5, 1939

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1940 MEETING A. P. C. G.

The 1940 meeting of the A. P. C. G. will be held during the week of June 17-23 at Seattle under the auspices of the Department of Geography of the University of Washington.

Howard H. Martin and Frances Earle will be in general charge of arrangements.

All members should plan to attend and make the 1940 meeting of the A. P. C. G. the largest yet held.

Geography and State Planning (Summary)

By WILLIS H. MILLER

Chief Planning Technician, California State Planning Board

The existence and nature of any direct relationship between geography and state planning are matters of considerable importance to workers in both fields.

There are almost as many kinds of geography as there are geographers. Only sound research in local economic geography, however, can be of any real interest to planners. Most geographers can not qualify in this particular, and many of those who might qualify do not make an effort to develop contacts outside the academic circle.

Planning is quite as heterogeneous in its composition and emphasis as geography. The chief levels of planning in the United States are city, county, state and national. State planning, because it deals with areas large enough to contain all or major parts of geographic regions, offers the best opportunity for geographers to make a contribution. At present more than 40 state planning boards are functioning.

The California State Planning Board during the last two years has investigated and reported on a number of problems having conspicuous geographic quality. Tax delinquent land is a good example. The State of California is nominal owner of some 3,000,000 acres of rural land and 300,000 lots and blocks in subdivisions owners for nonpayment of taxes. This land constitutes an invisible empire characterized by private failure, public liability, and legal mystery. None of it has made any contribution to the cost of government for from five to over sixty years. If the original owner's right of redemption were terminated and title quieted in the name of the State, this land would offer an unparalleled opportunity for scientific land planning. The Board, after an exhaustive investigation of the whole complex problem, recommended (1) a means for establishing the State's title, (2) a system for investigating and classifying the land, and (3) a procedure for its use or disposal. This plan was incorporated into a bill which has been unanimously passed by the Legislature. If it becomes law, the State, the counties, the cities and the taxpayers all should benefit.

Between state planning and economic geographers interested in local research there is a close relationship which should be developed into a cordial and mutually beneficial association. The geographers have ideas about regional development, and the state planners have a channel through which these ideas can be brought to the attention of responsible government officials.

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The Kabyles of North Africa—A Study in Mountain Adjustment

By HOWARD H. MARTIN
University of Washington

North Africa is part of the Arab or Moslem world. It is also Berber in its ethnic make-up, fifty per cent of its population being more Berber than Arab. When the Moslem wave swept westward along the Mediterranean littoral in the seventh century A. D. the lightly super-imposed strata of Roman aristocrats and administrators was at once engulfed. Luxurious Roman trading centers and provincial capitals were looted and destroyed. The great mass of the population, however, was too firmly rooted to be displaced at once. The Berbers (*berbere*, the Roman word for barbarian) were of sturdy stock and attempted to stand their ground. Killed by the thousand, they were often defeated but not destroyed. Gradually converted to Mohammedanism, they refused to learn Arabic, retaining their Berber dialects. Now, after the lapse of centuries, both races are found throughout north Africa; in many areas intermixture has produced a new ethnic strain. Large groups of the Berbers have received but scant infiltration, however, and are still stubbornly Berber in spite of many centuries of Arab dominance.

As in all such successful invasions, the conquered were forced back into poor or marginal lands, while the conquerors took over the more fruitful areas. Today the rich coastal littoral and the better plains of the interior are largely in Arab hands—or in the possession of still more recent French colonists.

North Africa contains at least five recognized agglomerations of almost pure Berber extraction, each isolated in what might be considered a relatively unfavorable environment. The Toureg of the Ahaggar Plateau in the deep Sahara, and the clannish Mozabite of the stony M'zab are examples of Berber desert-dwellers. The Riffians of the High Atlas, the Shawia of the Aures Massif, and the Kabyle of the Tell Atlas are Berber groups which have adjusted themselves to mountain areas. Each of these groups has either retreated from better lands in the face of Arab assault, or has clung stubbornly to an area so unfavorable that the invader has not cared to make the effort to conquer it.

All of these Berber groups have long been of interest to the geographer. In the autumn of 1931 it was the privilege of the writer to spend some time in the heart of the Kabyle country. Under the guidance of French geographers and army officers, entrance was obtained to villages and homes, and the local cultural adjustment studied at close range. This paper has grown out of field notes taken at that time.

French Control.

The present Kabyles are the descendants of those ancient Berbers known to the Romans as the Mauri, and the area now called Kabylia was included in ancient Mauretania. Actual Roman settlement within the Maurentanian highlands had never been extensive and the succeeding Arabs made only a limited penetration. The terrain was difficult for invading troops and, in a defensive sense, the Kaybles were a bitterly warlike people. Like the hedgehog with quills raised, they were ever ready to resist any encroachment upon

their freedom. The Arabs learned to leave them severely alone, and for many centuries they followed their own mode of life relatively free from outside interference. In fact, during a later period when the Arabs of Africa were forced to pay tribute to Turkish sultans, the Berber mountaineers evaded the exactions and even assessed transit taxes on Turkish emissaries passing through their territory.

Political independence ended when France took over Algeria in 1830. The new occupation was stoutly resisted by the Kabyles and it was not until 1857 that their last mountain stronghold surrendered. Active rebellion flared again during the Franco-Prussian war; Palestro, on the edge of the hills, was the scene of a massacre, this new uprising being suppressed with great difficulty.

Taking no further chances with the recalcitrant highlanders, the French colonial authorities increased the strength of Fort National, making it into a powerful military outpost. With its thick walls, ample garrison, and strategic command of the leading Kabyle towns stretching south to the Djurjura Mountains, Fort National became the symbol of French dominance throughout the region. The natives referred to it as "a sword in the heart of Kabylia."

During recent years only sporadic outbreaks of a minor nature have occurred but time has not served to mitigate the local dislike for French occupance. While visiting a Kabyle village the writer was an unseen witness to a flare of sullen resentment toward the French escort officer, as soon as that official turned his back. This bitter opposition includes passive resistance to nearly all French innovations—taxes, road work, military service, and even the attendance of children at French schools. French officials shrug their shoulders and say the Kabyles are a stiff-necked race.

La Grande Kabylie.

The Kabyle Berbers are scattered throughout the entire Tell or Little Atlas Mountains, from Algiers eastward to Constantine; there are also a few in Tunisia. The region where they dominate the entire culture pattern, however, is considerably more restricted. It is this region which the French call "La Grande Kabylia." There is no general agreement as to what this term includes, but it is not usually applied to the coastal (Sahel) area from the basin of the Sebaou north to the Mediterranean Sea. South of the Sebaou are the central Kabyle Mountains (the massif ancien) culminating in the grand chain of the Djurjuras, and here is the heart of Kabylia. Two other depressions, the Oued Isser on the west and the Sahel-Soummam Valley on the south and east, serve to set the final boundaries of this region. (See map.)

To obtain a pre-view of Kabylia, a north-south reconnaissance from the Sebaou to the Sahel-Soummam must first be made. Tizi-Ouzou, sometimes called the gateway to La Grande Kabylie, lies in the broad lowland basin of the Oued Sebaou at an altitude of 800 feet. With an easy gradient westward to Algiers, favorable communications with the coastal upland to the north, and several routes into the mountainous south, Tizi-Ouzou has become the regional crossroads and a leading market center.

Leaving the valley of the Sebaou the appearance of the country changes gradually from that of an undulating piedmont to a dissected mountain area with great, irregular rolling slopes. Here the granites and chists of the massif ancien, more or less metamorphosed, have been highly eroded. Slopes become steeper and ravines more sharply defined until Fort National is reached at an elevation of 3100 feet.

Fort National has a panoramic sweep of country. It looks down on the Sebaou basin to the north; to the south it commands the Kabyle Mountains with their sharply etched ridges and irregular roundtops, which rise gradually to the chain of the Djebel Djurjura.

From Fort National south to Mi-

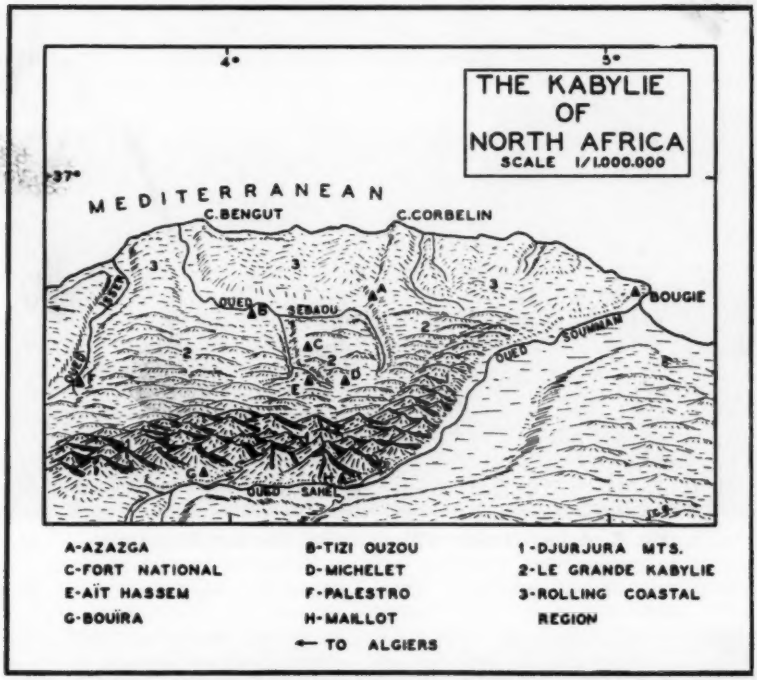

Fig. 1. Map of La Grande Kabylie, Algerian Tell Atlas.

Fig. 2. A Kabyle village, Fort National.

Fig. 3. A typical ridge village in the Djurjura Mountains.

Fig. 4. Harvesting an olive orchard near Michelet.

chelet (4000 feet altitude) the main highway traverses the heart of La Grande Kabylie. There is almost no level terrain. Roads are tortuous, crossing deep ravines, following the more favorable mountain flanks, skirting the edge of precipices, angling upward to take advantage of a low saddle in an obstructing ridge. Many of the ranges are roughly parallel; others observe no particular arrangement. Beyond Michelet the highway approaches the flank of the folded Djebel Djurjura. This grand chain of youthful mountains, composed mainly of limestones and red sandstones, forms a continuous 25-mile rampart between Kabylia proper and the high plateau of central Algeria. In altitude it averages over 6200 feet, its highest peak, Lalla Kredidja, reaching 7540 feet. The limestone crest of the Djurjuras is bare most of the year but is imposingly snow-capped during three or four winter months. The range may be crossed by three or four routes, the most famous of which is Tirouda Pass, a broad table-gap (5900 feet) not too difficult of access. From the pass on a clear day there is a sweeping view of the Sahel-Soummam Basin below. A winding 20 mile descent to the south ends at the prosperous French city of Maillot, regarded as the southern gateway to Kabylia.

Rainfall is mainly the result of low pressure areas over the Mediterranean in winter. Along the coast precipitation decreases from west to east; Algiers receives an average of 30 inches, while Tunis gets only 18 inches. The Kabyle Mountains are near the sea and in a relatively short distance the altitude increases from 1000 to 6000 feet. The resulting rainfall is, in the main, greater than that along the coast, most of the highlands receiving from 20 to 35 inches. The Djurjuras are especially well-watered; including winter snows the grand chain averages 40 to 50 inches annually. As in all Mediterranean regions, the seasonal character of the rains constitutes a drawback. Most of the oueds and gorges which are virtually dry during the summer season become torrential mountain streams for short periods during the winter.

Vegetation is of the semi-arid or "Maquis" type characteristic of Mediterranean margins. Cactus with broad pads is common everywhere. Drought-resistant plants and stunted bush growth is occasionally replaced by cork oak forests. The olive is indigenous. Some of the better watered mountain sides are well wooded, and there are a few fine cedars. The richest verdure is naturally found in deep valleys leading out of the Djurjura Range. After the rains pastures quickly spring to life, then become burned and barren before the next season's downpour. Lack of fuel and the incessant grubbing of bushes for fire wood has resulted in many badly denuded hills where erosion has taken heavy toll.

Village Characteristics.

The most striking feature of the Kabyle culture pattern is undoubtedly the mountain top location of all villages. Entering the highlands anywhere south of a line drawn from Tizi-Ouzou to Azazga, one is seldom out of sight of one or more towns. Strung along a sharp-crested ridge, or forming a compact little cluster on the top of some conical hill, the red-roofed Kabyle village etched against the sky is an unforgettable sight. From a high vantage point it is often poosible to count twelve or fifteen such agglomerations, each on its own peak, aloof and distinct from its neighbors. In style of house, lack of outstanding public buildings, and simplicity of street arrangement all the villages are similar. Michelet facing the Djebel Djurjura is the center of a district where nearly every crest and knob has a town of 100 to 3,000 population. One of the largest native centers, Ait Hassam, claims about 5,000 people.

Although these villages now show no evidence of fortification, their location is obviously a survival of the defense motif so familiar to the anthropogeographer. The commanding location with difficult approach and

clear panoramic view, gave the ancient village dwellers time to marshal their defenses against an approaching enemy. Unlike the arid pinnacle habitat of their southern Berber cousins, the Aurès shepherds, the village sites of the Kabyles are not impregnable, as sometimes stated. Most of them can be approached by a winding trail with a moderate gradient; only a few have a fortress-like steepness. In ancient times, however, these slopes must have afforded the maximum of difficulty to hostile foot soldiers or even to horsemen.

French engineering has transformed some of the mountain roads into fast modern highways. Back from these main arteries are scores of rutted native roads, half as wide and twice as steep, where a motor bus must labor in low gear. Beyond this network of secondary roads are hundreds of well-worn footpaths which ascend steeply into the mountains to obscure but teeming villages. From sunrise until sunset the roads are alive with people. Men and boys stalk along, staff in hand, driving two or three sheep or a silky-haired kid. Old mountain women come down from scrubby hillsides, bent almost double under a load of brush and faggots. Young women walk to market with bales of grease wool or bundles of farm produce on their backs. A pottery vendor trudges beside a load of reddish-brown jars, securely lashed on the back of his mule. Occasionally there is a trading caravan of five or six camels, usually an itinerant Arab family inbound over Tirouda Pass, with dates from the desert and barley from the high plateau of Setif. Everywhere men and women are busy in hillside groves and gardens.

Tree Crop Agriculture.

The regional economy of Kabylia is based upon agriculture of a highly specialized type. The meager plains and alluvial valley bottoms, along with some of the nearly level bench-terraces, are farmed to the limit under the usual Mediterranean system of fall plowing and winter wheat, taking advantage of winter rains. Here water is not the limiting factor, either in regime or amount, although the runoff is somewhat excessive. For steep hillside and mountain slope, much of it thin and stony, another system is used. Through centuries of trial and error the Kabyles have evolved their own version of tree crop farming.

Responsive to winter rainfall and tolerant of summer drought, the deep-rooted olive has become the leading crop over practically the entire extent of Kabylia, from the rough coastal hills of the Mediterranean margin to the steep slopes of the Djurjuras. A grove of olives, or even a few scattered trees, provides the Kabyle horticulturist with his surest source of income. Most of the groves are small; some gardeners have only a few trees, others perhaps only one. Cases have been reported where several owners shared a tree, or a man leased certain specified branches, retaining the others for himself. Harvest time is the big event of the year. Ripe olives are placed in a shallow stone vat and crushed by a heavy stone roller; the pulp is then placed in wooden presses and the oil extracted. In the past, each village pressed its own olives and great jars of oil were stored in every house. More recently modern steam-powered mills have been built in many of the larger centers to which growers within a reasonable distance bring their olives to be crushed. Maillot, on the southern slope of the grand chain, is one of the more scientifically developed olive centers. Ancient and gnarled olive trees, young trees of carefully grafted stock, extensive and well kept groves, single trees in badly drought-bitten spots—Kabylia is the land of the olive.

The fig is equally well adapted to rugged hillsides and Mediterranean climate; locally dried figs are found in the larder of every family. Other tree crops adjusted to this area and grown to a lesser extent are the peach, the orange, and the almond. Vineyards are found in certain centers, although, as Moslems, the Kabyles are not generally wine drinkers; the grape

is distinctly a minor crop, but has fine possibilities for future expansion. Modern horticulture is one of the subjects now taught to boys in the local schools.

Along with their trees, the Kabyles farm irregular garden patches with the usual array of beans, peas, lentils, potatoes, and other vegetables. Wheat and barley are grown in small plots almost like garden crops. Part of the local supply of cereals is obtained from the plateau to the south. Certain areas, particularly the more fertile Sebaou Basin near Tizi-Ouzou, produce excellent tobacco which is exported to France.

Sheep-keeping is also a regular part of the Kabyle subsistence economy, although these animals play a lesser role here than in the steppe desert or among the Shawia of the Aurès, who depend almost entirely upon flocks. Kabyle families seldom have more than a few head of sheep or goats which are kept mainly for wool or milk. The browse, ample during and immediately after the rains, grows scanty during the hot summer; sheep must be constantly shifted from one close-cropped hillside to another. The well-watered Djurjura Range provides what is probably the best pasturage; the larger flocks are found on these slopes and trans-humance is practiced to some extent.

Cattle are less common than sheep and goats, although the ox is one of the regularly used work animals. There are several recognized cattle-raising centers, including the French railway town of Bouira on the edge of the mountains. Pigs are fattened only in small numbers except where some of the cork forests afford sufficient acorns for larger droves. The donkey or mule is the animal of all work. He pulls the crooked plow, walks to market with panniers or pack saddle on his back, and, in autumn, trudges round and round a circular track to provide power for the stone olive crusher. At night he shares a corner of the house with the family.

It is obvious that by devoting their attention primarily to orchards the Kabyles have added centuries to the life span of their region. Although soil erosion has not been entirely avoided and many gullied slopes are visible, 1200 years or more of steady tree farming has been less destructive to Kabylia than one century of careless cotton cultivation in parts of the southern Appalachians. Much of Kabylia fortunately goes unplowed. Up hill and down hill the workers are busy in the reddish soil of orchard and garden, weeding, digging, pruning, thinning, grafting. Only by such intensive methods, plus a very simple mode of life, has it been possible for Kabylia to become the most densely peopled region in Algeria. If all Algeria were populated to an equal density, it has been estimated that the country would have 100 million people instead of its present 6 million.

Village Life.

It is apparent that this rigid adherence to skyline habitation has intensified the difficulty of normal village life. Orchards may begin directly below the houses, but only too frequently the farm acreage lies far below the village, sometimes at a distance of several miles. In order to tend his figs and olives, or till his small patch of beans or barley, the householder must trudge long distances carrying his tools. The harvest resulting from the season's toil must be laboriously transported up hill for processing and storage. Water for all household use must also be carried. The local spring is naturally some distance down hill, perhaps on the margin of a distant valley. Part of the daily task for women and girls is the trip to the spring, climbing back up the mountain with a tall water jar balanced on the shoulders. To avoid the additional weight of the heavy clay jar, metal containers, frequently cast-off gasoline tins, have become more common in recent years. Visits to neighboring villages and a trip to a favorite weekly market also entail much walking.

Kabyle houses lose some of their picturesqueness upon close examination. They are simple, sturdy one-

story affairs, the walls constructed of stone and mud, and the sloping roof of rough red clay tiles. The latter is in sharp contrast to the Arab house with its usual flat roof. The single door is so low that an adult must stoop to enter; there are no windows and no chimney. Smoke from the hearth rises to the ceiling and eventually escapes through a small slit-like smoke hole in one gable, or finds its way out under the loosely-joined eaves. The floor is of hard-packed dirt. The ordinary house has one room, which is divided in the middle by a little wall; the family occupies one side and the other is for the livestock—the horse or donkey, perhaps a cow, some sheep or a pig, and nearly always a number of chickens. A prosperous villager with a larger house and with more floor space may have as many as three rooms under his roof—one for the masculine members of the family, another for the women and children, and a third for the livestock.

There is almost no furniture; the household sleeps directly on the floor. Among the furnishings are earthenware pots, jars and platters, a grinding mill which is turned by hand, and sometimes a few highly prized utensils of iron, brass, or copper. A unique feature of most Kabyle houses is the great clay jars, for the storage of provisions. Often as large as a barrel, with a tight fitting lid or cover, they frequently have one or more holes in the side through which grain, olives or dried fruit may be reached by inserting the hand. Sometimes two of these jars are set up high on a masonry foundation and plastered together with clay which is ornamented with bold geometrical design.

Since Kabylia is still largely in the household stage of manufacture, most of the clothing is made at home. The wool from a few sheep is more than sufficient to clothe the entire family. Women care for the sheep, do the shearing, wash and card the wool by hand, and carry on the spinning, dyeing, and weaving. Some spinning is still done by the primitive spindle, but spinning wheels are now standard equipment in most Kabyle homes. The predominant equipment of the wommen's quarters is usually a vertical hand loom for the weaving of woolens. In addition to cloth for gandoura and burnous, shawls of good pattern, and blankets in stripes or solid colors are regularly made.

In addition to the usual homecrafts, certain villages have their own specialties. Every village has several skilled pottery makers but some of them, as Taourit Amokran near Fort National, are famous for finer grades of earthenware having more than local distribution. Some of their jars follow models used in Carthage more than 2000 years ago. There are several centers for iron-working, especially cutlery and farm tools; gunsmithery, once a highly skilled craft, has been discouraged by the French authorities and has now fallen into disuse. Among the most skillful workers in metals are the Beni Yeni tribesmen who make native Kabyle jewelry in silver, white metal, and sometimes gold. Their designs are coarse and they prefer geometrical patterns to those taken from nature. While the Kabyle do not seem to be a particularly artistic people, they cling tenaciously to what arts and crafts they do possess.

Kabyle Women.

Despite her life of drudgery in hilltop home and hillside orchard, the Kabyle woman is a colorful figure when she appears in public or visits one of the weekly markets which often serve as semi-social gatherings. For ordinary work days she dresses in sombre native wools, generally black or dark blue. She is fond of bright colors, however, and gay cotton prints or muslins from European mills are great favorites. A pattern seen so often that it may be regarded as typical is a print of dark red with bright yellow figures or polka dots. Green is also a favorite color. A bright kerchief crossed around the back of the head and knotted in front is a regular article of attire. For more festive occasions as many as six handkerchiefs of different colors may be

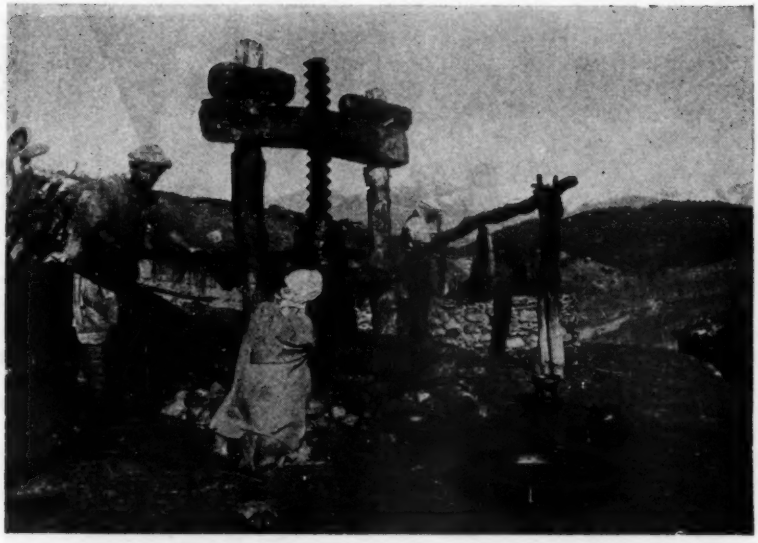

Fig. 5. Old wooden press and stone olive crusher.

Fig. 6. Kabyle school: instruction in grafting young olive trees.

Fig. 7. Interior of a Kabyle house, showing types of storage jars.

Fig. 8. Kabyle women carrying water from spring.

arranged one over another, making an elaborate turban-shaped headdress.

Although they are Mohammedans, Kabyle women have far greater freedom than their Arab sisters. They have never worn the veil; they also tattoo the face and sometimes the hands, a practice forbidden by the Koran. Interestingly enough, one of their favorite designs is the emblem of the cross, pricked out in blue on forehead or chin—perhaps a heritage from the pre-Moslem past when Christian refugees from Imperial Rome fled to these mountains for sanctuary.

Inordinately fond of jewelry, they still prefer native Kabyle designs, of barbaric but solid workmanship, rather than cheap European trinkets. Heavy silver chains, large hoop earrings, broad bracelets and tinkling anklets are worn in profusion by the well-dressed maid or matron. A standard Kabyle emblem of ancient Berber pattern is made in the form of a huge brooch ornamented with a rough design in semi-precious native stones. An elaborate silver ornament with colored stones inset and small pendant drops attached is frequently worn on the front of the headdress. Thus be-decked an be-jeweled, with lithe carriage and head held high, the mountain woman of Kabylia has an air of competence and independence foreign to the more secluded Arab woman.

Mountain Democracy.

In spite of his excellent physique and hard-headed ability the Kabyle man makes a far less attractive appearance than his women folks. The men care nothing for dress. Unlike the desert Arab with his picturesque burnous and richly ornamented cloak, the Kabyle dresses as a rule in shabby and nondescript garments. A prosperous farmer with several hectares of olive orchard wears practically the same ragged garb as his poorest laborer. The well-to-do seldom have finer houses than their humbler neighbors, and there is no other observable form of display.

This lack of outward distinction in individual life is paralleled by the system of local government. Each village is ruled by the Djema'a, or town council. This thoroughly democratic body, the supreme authority in local affairs, is composed of the elders or heads of families. Poverty and wealth sit side by side, in socialistic simplicity. Each village Djema'a, somewhat similar in operation to the New England town meeting, settles all local questions, including disputes over livestock, property and boundaries; it formerly tried cases involving crimes of violence, including the ever-common mountain vendetta. Like the Appalachian feud, the Kabyle vendetta was prone to continue generation after generation, with men killed alternately by each clan or faction. Vendettas are less frequent today, as they are now under the ban of French law.

Population Pressure.

With limited resources and excess population, Kabylia is admittedly a region of scant opportunity and low standard of living. As early as 1873 a keen observer stated that every available nook and corner in these mountains was cultivated to the utmost, and commented on the extreme (to him) poverty of the people. This condition may also help to explain why polygamy, permissable under Mohammedanism, has been little practiced in Kabylia. The economic check is one which frequently operates in limiting plurality of wives among a people whose code sanctions it. A land so poor and so crowded has also failed to tempt French colonists; the Kabyles have been left relatively alone in the security of their mountains, free from competitive infiltration.

Every year hundreds of mountain Berbers stream into the wheat-raising plateau of Setif, where they compete with the migratory Arabs of the desert for temporary jobs as harvest hands. Others descend to the richer Mitidja to become vineyard workers, or cross to France as laborers or factory workers, often sending part of their wages back home. Surplus sons frequently enlist in the army. For

many years some of the smartest and best fighting units of French colonial troops have been drawn from this region. The colorful Zouave regiment was originally Kabyle, the name itself being a corruption of Zouaoua, the name of a local tribe famous for its fighting ability.

Summary.

The Kabyle in his restricted environment today provides one of our most interesting studies in mountain geography. A thorough-going isolationist, he has resisted Roman, Arab, Turk, and Frenchman, adopting little of their respective cultures. He has a unique village location based on the defense motif. Severely conditioned by the steepness of available land, he has evolved an intensive tree-crop horticulture which supports the maximum in population and has at the same time preserved the region from destructive erosion. He possesses most of the well-known characteristics of the highlander: defiant individualism, stubborn aloofness, love of freedom, clannishness, simplicity and frugality, and a high degree of sturdy independence. With the saturation point in population now reached, the self-sufficient regional economy is being modified, but is still dominant. The present trend indicates an increasing impact of French civilization and a gradual breakdown of regional isolation in Kabylia. It will be interesting to observe the resultant future modifications in this land of ancient survivals.

White Acclimatization in Tropical Queensland

By FRANCES M. EARLE
University of Washington

The recent persecution of racial and religious minorities in Europe has served to focus world attention upon the possibility of refugee settlement in sparsely populated areas. Various tropical countries have been discussed as possible permanent homes for these white colonists from Europe. Much of the discussion has been vague and has dealt only with available land area, paying but scant attention to the far more important questions of economic production and physical habitability. Sweeping statements have been made that such-and-such tropical land can accommodate thousands of new and untried colonists. Equally sweeping assertions followed that the same territory was not a "white man's land". In the larger share of these cases tradition, racial prejudice, or political opportunism have so swayed the analysis that it has been difficult to arrive at the truth.

Australia's tropical state of Queensland has been among the areas most frequently discussed as an outlet for refugees. It is pointed out that Queensland is sparsely populated, has greater potentialities for further economic development than any other of the Australian states, and is eager to receive new colonists—particularly Europeans. Assuming that there is plenty of available and potentially productive land, that the immigrants would be politically acceptable, and that they have a fair chance of making the necessary social and economic readjustments, the question of white acclimitization remains. Can Europeans settle in tropical Queensland, become part of its working population, and retain their health and vigor? This question has been argued pro and con by plantation owners and colonial administrators, by climatologists and medical authorities. The man on the street has his own emphatic opinion, sometimes based upon personal experience, sometimes on nothing more tangible than hearsay. Having heard this question discussed by many experienced Australians, and having seen at first hand some of the results of European colonization in this tropical state, the writer wishes to approach the problem almost entirely from the Queenslander's point of view.

Traditionally the Britisher in the tropics goes out as government official, businessman, manager, or overseer, but not as an ordinary laborer. Queensland's early leaders were firm believers in the dark-skinned labor theory—management and direction to be supplied by the British planter class, all physical work to be done by natives inured to tropical heat and humidity. The climatic advantages of Queensland for the cultivation of sugar cane, tobacco, cotton, pineapples, and other tropical products was recognized quite early in the Colonial Period (1860-1900). Sugar planting was begun in 1861. Under the high price stimulus of blockaded cotton ports during the American Civil War, cotton plantations were started about the same time, only to collapse with the resumption of Southern exports. Cane growing was more successful, with a profitable market in Australia itself and many new plantations steadily cut out of the bush.

The aborigines were hopeless as plantation laborers but thousands of Polynesians and other dark-skinned islanders were brought in as indentured laborers. These natives were called Kanakas, a collective term loosely applied to all colored labor. Supposed to be used only for agriculture, the Kanakas were frequently illegally drafted for any type of heavy labor in the colony. Because of the oppressive work, poor food, and unsanitary living conditions their mortality was extremely high. By 1900 the records show that some 60,000 Kanakas had been imported, but the excessively high death rate plus the re-

turn of natives who had served their contracts make it unlikely that the colony had at any given time more than 10,000 or 15,000.

In addition to the plantation owners with their Kanaka labor, a different type of working man had been entering Queensland. Several waves of Britishers had migrated to Australia empty-handed, hoping to make a strike of some kind. Still empty-handed, many had drifted northward through the Darling Downs, to become squatters or work for wages on the larger stations (sheep or cattle). As an aftermath of the Victoria gold rush scores of unsuccessful prospectors also went to Queensland to try their luck. A few profitable mining areas were opened up, including Charters Towers in the 1870's and Mount Morgan in 1882, but mining was not sufficiently extensive to absorb all the white workers. Hundreds of ex-prospectors and idle miners remained in Queensland as residual settlers, locating mainly in towns, and searching for any kind of available work. They seldom competed directly with Kanakas on the plantations, but the feeling was prevalent that low-paid Chinese and Kanakas had a depressing effect on the wage scale for white labor.

When Federation was proposed in the 1890's, the older colonies in the south were in favor of a White Australia policy. Queensland's price of admission to the Federation included the exclusion and repatriation of all colored labor. The large plantation owners were alarmed. In the real wet-and-dry tropics farthest north the planters were quite insistent on retaining their traditional system, fearing that they would otherwise have to abandon all operations. After considerable controversy the issue was settled by an overwhelming desire for free trade with the rest of Australia, plus the determined stand of the white squatters, ex-miners, and small townsmen against colored labor. Queensland entered the Commonwealth, subscribed to a white Australia, agreed to send all Kanakas home and to exclude Orientals.

Following the formation of the Commonwealth in 1901, the white Australia policy became the basis for years of argument in Queensland. Two questions were raised. First, was it possible to continue plantation work using white labor? The idea that British working men might be able to do field work under a tropical sun was regarded as revolutionary. Second, if such labor received wages sufficient to support the higher stanard of living necessary for white people, would it be possible to maintain the sugar industry in competition with other sugar areas paying a low wage scale? Government subsidy to the sugar planters provided a partial answer to this second question. And, by the time the last Kanaka had been shipped out in 1906, the industry was rather far along toward an answer to the first query.

Brought face to face with the problem of doing their own field work the Queenslanders found that most Europeans who had already spent several years in the gold fields or as station hands in hot and humid areas were sufficiently acclimated for general plantation labor. While admitting that such work was often hard and exhausting, it was not necessarily more arduous than mining or road building under similar climatic conditions. The widely predicted collapse of the sugar industry did not occur. On the contrary, by 1908 about 87% of the sugar was grown by white labor. Even during the early period of readjustment planting was not curtailed. The 1900 cane acreage of 108,535 increased to 141,779 in 1910, the government bounty aiding greatly in tiding the growers over this period. The World War and resultant higher prices encouraged a further rise to 162,619 acres in 1920. Acreage increased to 296,070 in 1930, and to 338,686 in 1936. Bounties have been continued as part of a regular policy. Production costs, admittedly higher in Queensland, make it unlikely that this region will ever compete in tonnage

with such low-cost growers as Cuba or the Dutch East Indies. Production is at present more or less adjusted to the normal requirements of the Australian home market plus Empire quotas, but there is no attempt to grow a surplus for the world market. For the purpose of this paper, however, the economics of sugar production is not of prime importance.

In addition to the dominant crop of sugar, two other plantation products, cotton and tobacco, are being cultivated by white labor. Cotton planting, tried and abandoned in the 1860's, was reestablished about 1920. A heavy bounty given growers by the Commonwealth government in 1924 caused acreage to expand steadily. Of special interest from the labor standpoint is the fact that much of the cotton is produced by small-scale farmers who do their own field work. Tobacco was grown in a small way from Colonial times, reaching a production peak in 1895, then declining almost to the vanishing point in 1925. Following 1930 tobacco planting was revived, again under the stimulus of high tariff protection. At present some 4,000 acres are under cultivation, with Italian laborers doing most of the field work. Tropical fruits, including pineapples, bananas, oranges, etc., are widely grown for local use but are of minor importance in trade.

The fact of paramount significance in this resume of Queensland's tropical crops is that for a third of a century all the field work, plowing, planting, cultivation, and harvesting has been done by workers of European stock. Only in Queensland is sugar cane successfully grown and cut by white labor. Work in the cane fields is difficult, requiring skill, alertness, and physical stamina. The authorities now adopt the attitude that it has already been successfully demonstrated that white people can live, work, reproduce, and maintain a satisfactory society in a tropical environment of this type. To substantiate this position, three main types of proof are advanced:

1. The Decline of Tropical Disease. The absence of subject peoples with the usual tropical diseases has simplified the health problem. The exclusion of imported colored labor is said to be the finest thing which ever happened to Queensland, and the aboriginal population is too small to constitute a health menace. In 1938 it was estimated that there were approximately eight thousand aborigines (including half castes) in the state, about half of whom live in settlements or reserves. In his official report for 1938, the Government Statistician stated that only 42 cases of typhus fever and 243 cases of malaria had been treated in public hospitals in 1936. In that year there were three deaths each from typhus fever and malaria. Hookworm is decreasing and not a single case of plague has been reported since 1922. In Queensland the leading causes of death are diseases of the heart, cancer and other malignant tumors, pneumonia, nephritis, accidents, etc.—a list which is not dissimilar to death causes in the United States. Official statistics indicate that the larger percentage of deaths are due to middle latitude rather than tropical diseases. Tropical deseases have decreased steadily.

2. High Birth and Low Death Rates. As further indication of healthful living conditions, the birth and death rates are cited. Since 1861 Queensland has had a higher birth rate than the Australian average. In 1937 Queensland reported 19.36 births per annum per 1,000 population, while the Australian average was 17.43. It is interesting to note that the birth rate in the more tropical portions of the state is higher than in the cities—21.2 in contrast with 15.7 per 1,000. Queenslanders also point with pride to a steadily decreasing death rate, both crude and standardized rates being below the national average. In 1937 the crude death rate in Queensland was 9.10 while the Commonwealth average was 9.44 per 1,000; the standardized rates, 9.02 and 9.12 per 1,000.

3. Increase in Acclimated Queens-

landers. As evidence of the habitability of this tropical state, the steady increase in Australian-born population is significant. In 1921, 78 per cent of the total population of Queensland was native born, while in 1933 the percentage had increased to 83. There has been, of course, an increase in the Australian-born population in other states as well. There are now first, second, and third generation Queenslanders living and working as in the middle latitudes. They are engaged in all types of activity, from manual labor to the most highly intellectual and scientific work. These native Queenslanders, born in the tropics and fully acclimated, have apparently an unimpaired energy and vitality comparable to that of the European parent stock. The development of such a white population under tropical conditions during a seventy year period of occupance ranks as an achievement of no small importance.

One of the agricultural problems of Queensland in recent years has been the tendency of labor to gravitate to urban areas, preferring any type of town job rather than work on the land. During the past decade, when tobacco and cotton acreage was being expanded under the stimulus of government bounties, part of the added labor demand was met by the immigration of south Europeans, chiefly Italians. They were generally welcomed as an addition to the labor supply,and now constitute the largest non-British group in Queensland (8,343 in the 1933 census), but only a very small percentage of the total population. As plantation workers they have skill and endurance, rating highest of all first generation immigrants, but second to native-born Queenslanders. Objections are sometimes raised that the first generation Italians and Greeks work longer hours, accept a lower standard of living, and have a higher birth rate than Australians. Second and third generation Italians are easily assimilated, however, and constitute no social problem.

Queenslanders are today acutely conscious of the necessity for planning their future regional economy along sensible lines, but the formation of a sound policy has not been easy. There is first of all a large and influential group which looks with distrust at plantation agriculture with its need for large numbers of laborers. This group insists that the most desirable policy would be to minimize plantation crops and concentrate more heavily upon the animal industries which require far less labor. Forgetting that most of the range land is already overgrazed, they argue for more sheep and cattle. In general this is an attempt to retain the old ranch economy, including the traditional benefits of large land-holdings and a sparse population. This is, however, contrary to the Government policy of buying large stations and dividing them into smaller acreages in order to encourage closer settlement.

A second but smaller group looks with longing at the easy-going luxury of the planter class in other parts of the British-ruled tropics where a plentiful supply of colored labor does both field and house work. This group believes that they are handicapped by the lack of low-paid servants. Medical men do not share this opinion, citing many examples of progressive deterioration where upper classes lived in idleness. In the wet tropics both men and women seem to make a healthier and happier adjustment if forced to lead a moderately active life.

Most Queenslanders now believe that their present system of developing an active working class is the best for all purposes. No insuperable obstacles to successful white settlement have so far been encountered. Adjustment to tropical conditions is still far from perfect; improvements still need to be made in diet, sanitation, and housing.

Most interesting of all, the second and third generation Queenslander is now recognized as a distinct Australian type, just as is the Victorian or Tasmanian. In discussing this experiment in acclimitization with Dr. Raphael W. Cilento, Director of the

Australian Institute of Tropical Medicine, he expressed the opinion that the Queenslander is still in the transition stage and is in process of evolving "a distinctive tropical type". This transition is well under way and has already progressed far enough to make Queensland one of the most interesting areas of white occupance in the low latitudes.

Some Factors Affecting Pacific International Relations

By OTIS W. FREEMAN
Eastern Washington College of Education

According to John Hay, Secretary of State under McKinley and Theodore Roosevelt, "the Mediterranean was the ocean of the past, the Atlantic the ocean of the present, and the Pacific the ocean of the future." It will be of interest to consider the factors involved and to determine, if possible, whether the prophecy of forty years ago is likely to be fulfilled.

The Pacific is incomparably the vastest body of water on earth extending for 10,000 miles of latitude south from Bering Straits, and an equal mileage of longitude along the equator. Covering two-fifths of the earth's surface, the Pacific exceeds in area all the continents and islands in the world. Adjoining the Pacific on the west is Asia, the largest and most populous continent on earth, the source of all great world religions, the probable original home of man, and the site of conflicting races, cultures, and philosophies that have in the past and will continue in the future to greatly affect the entire world. On the east are the Americas, and southwest is Australia and the East Indian islands, relatively empty lands compared with the teeming millions on the soils of Asia, but these thinly populated areas contain enormous mineral and forest wealth, sources of foods and materials for manufacture greatly needed for Asia's industrialization and her growing hordes of people.

In popular parlance, the Mediterranean side of Asia is the Near East and China and Japan constitute the Far East. But to us on the Pacific Coast the lands reached by following the sunsets across the big Pacific may be better named and more aptly thought of as the "Near West".

Members of nearly all the races and cultures of mankind touch the Pacific area. The ideals and ambitions of the races and nations vary as widely as the broad ocean itself. The color of the humans may be white, black, brown, yellow, or chocolate; their religion may be Brahmin, Christian, Buddhist, Orthodox, Parsee, Shinto, Confucian, Moslem, or primitive nature worshipper; they may vary in civilization from primitive hunters, fishermen and gatherers of the bounty of nature, through herdsmen, farmers practicing spade and hoe agriculture, and craftsmen manufacturing articles by hand processes in their homes, to the farmers, merchants, and workmen of the complex, modern, industrialized civilization. Attitudes of the various peoples and the adherents of different deligious faiths differ greatly as to what constitutes the important things of life. Many Orientals blessed with a patience, resignation and fatalism rare in the Western world willingly labor all their lives for a bare sustenance and die contented and happy if they but had an elaborate wedding, left sons to perpetuate their family and are buried with pomp and ceremony. In constrast we Westerners too often feel discouraged and chagrined unless income and profits show an increase each pear, unless everything new is bigger and finer than what has preceded, unless we have sucess and thereby gain recognition, unless we continue to invent machines that replace human labor and new methods to deal out death both to warriors and innocents alike, and thereby enable us to overcome and dominate the "back-

ward" races more concerned than we with family life and the hereafter than in modern "efficiency". The struggle for an existence in the Orient is almost beyond the comprehension of an American. Millions live, breed, and die with rarely if ever knowing the feeling of complete repletion with food. A Chinese does not greet a friend by saying "How are you," but "Have you eaten your rice?" The Hindu farmer has but two extravagances: marriage and burial; for relaxation he goes on a pilgrimage.

Physical Factors in the Pacific.

The Pacific Ocean may be divided into two parts on the basis of differences in relief. The eastern portion is a basin with a nearly uniform depth of three miles and almost devoid of islands, while the western part varies between submarine ridges with associated shallows and banks, above which rise thousands of islands and beside which extend elongated deep troughs which contain the most profound depths found in any ocean, 35,400 feet, east of the Philippines. The shorelines likewise vary, that on the east having a generally smooth coast except in the extreme north and south of the Americas, and is hemmed in by high mountains closely adjoining the shore, through which break only a few major streams, mostly unnavigable. The northern and western shores face a festoon of enclosed seas protected by chains of offshore islands, the Aleutians, Kurile, Japan, Ryukyu, Formosa, and the Philippines to the East Indies and Australia. Into the ocean from Asia pour some of the greatest rivers on earth, in whose fertile valleys and associated coastal plains live over five hundred million people, as compared with a scant thirty millions on the American side. Southward the open ocean continues to the icy waste of Antarctica. Large islands adjacent to the shores of continents mainly resulted from foldings and uplifts of the ocean floors, but the small islands in the Pacific area are generally of volcanic origin, or if in the tropics may be formed of either volcanic or coral rock. However, several island groups east of Australia like Fiji, New Caledonia, and New Hebrides contain crystalline rock and appear to be remnants of a once large land mass or continent, most of which has floundered beneath the sea.

The northeast and southeast trade winds combine with the westerlies, along with other factors, in producing two huge oceanic drifts that rotate clockwise in the northern and counterclockwise in the southern Pacific. These and other ocean currents together with the prevailing winds have helped materially in the spread of plants and small animal life, and also have affected the native settlement and routes of European exploring navigators. Even the climate and passing weather of the continents is largely affected by the distribution of large high and low atmospheric pressure areas over the Pacific. The direction and location of prevailing winds, like the trades, westerlies and monsoons, largely determined the routes taken by ships in the days when trade was carried by sailing vessels. The monsoons, winds that are the dominating environmental factor of southeast Asia, shift with the seasons, blowing from high pressures at sea to low pressures on land in summer and causing a rainy season then; and from high pressures on land to low pressures at sea in winter, the dry season. The north Pacific "high" usually spreads into the northwestern United States in summer, bringing fair, dry weather while most of the cyclonic storms in the same area originate in the Aleutian "low" of the north Pacific. The vast quantities of heat transported from the tropics into higher latitudes by the northern portion of the north Pacific drift, called the Japan current, is an important factor affecting the temperature and rainfall of northwest America. The cold Kamchatka Current off Siberia, and the cold Peru Current off western South America are factors in making these regions favorable for fish. Other important fishing grounds are located near the contact of cold currents

with the warm Japan current from near Puget Sound to the Gulf of Alaska.

Natives of the Pacific.

The original home of mankind is generally assumed to be the mainland of Asia, out from which for many thousands of years have come waves of migrating humans. The first migrants moved southeast from Asia following the bridge of islands from the Malay Peninsula to Australia that had possibly fewer and narrower straits then than now. These natives were low in the scale of human achievement and are probably represented by the pigmy negritos found in remote mountain forests in the interior of Luzon, Borneo, and New Guinea and by the Australian native "blackfellows". Later came the huskier and more intelligent blacks, called Papuans and Melanesians, that occupied New Guinea, the Bismark Archipelago, Solomon Islands, New Hebrides, New Caledonia, and other groups southeast to Fiji. Several migrations of Malays occupied the East Indian Islands and the Philippines, the more vigorous later comers usually driving the earlier arrivals inland or to more remote and less desirable lands. Whereas the earliest migrants knew nothing of agriculture and had only one domestic animal, the dog, to aid in hunting, the later natives were experienced farmers bringing seeds of many plants and several domestic animals.

Some thousands of years ago, either toward the close of the glacial period or soon thereafter, Mongoloid Asiatics crossed into America by way of the Aleutian Islands and the Pacific Coast, and probably came also across Bering Strait, the Yukon Valley and southward on the Great Plains east of the Rocky Mountains. These Asiatics brought no seeds with them, perhaps because of the inclement climate of regions traveled en route, but later domesticated maize, beans, squash, and other crops in their new home. The American Indians were not lacking in natural intelligence but their advance along the road of civilization was handicapped by lack of domestic animals, only the dog besides the llama of Peru being available as beasts of burden. To complete the occupation of a continent was a slow process to primitive natives. Doubtless many centuries were required before groups of hunters would push down the entire length of the Americas. None of this migration ever peopled the Pacific Islands due to the expanse of ocean and lack of sea-faring ability. The Pacific islands are most accessible from the west and were settled from that direction.

At an unknown time the Ladrone (Marianne), Caroline, Marshall, and Gilbert islands lying north of Melanesia were settled by a Malay-like people, the Micronesians, meaning inhabitants of the small islands.

The last great migration consisted of the Polynesians and began sometime in the Christian era, perhaps sixteen or eighteen centuries ago. Leaving their homes somewhere in southeastern Asia groups of Indonesian people of white ancestry, possibly related to the Ainu of Japan, and with probably some admixture of Malay and less likely to some Mongoloid blood, navigated their steady sea-going canoes straight through the populated Caroline islands and New Guinea into the unexplored Pacific in search of new homes which they found on the tiny spots of land dotting the ocean. En route they intermarried to some extent with the Melanesians by which some oceanic negroid blood was introduced. By long fusion between the different racial elements the fine appearing and intelligent Polynesian race developed. From settlements in Tahiti and other islands they explored the mighty Pacific, and by six to ten centuries ago had discovered and settled on practically all of the South Sea Islands. Their land of Polynesia had the shape of an enormous triangle and extended from Hawaii on the north to New Zealand on the south and on the east from Easter Island westward to the Fiji group which was populated by Melanesians but who had more of a Polynesian culture. The

Polynesians attained their highest culture on the high fertile volcanic islands and in New Zealand, that possessed the most resources and where populations could increase and knowledge develop. The small coral atolls could support only limited numbers of natives and because of the few available resources the culture of the inhabitants could not advance to the same degree as on the big islands.

The Polynesians developed a type of culture well suited to their environment. They brought a few plants like the taro, yam, breadfruit, and banana with them in their migrations. The pig was also usually introduced. Few native food plants occurred but considerable supplies of food were generally available in the ocean and along the shores. The natives learned to make cloth, healthy, airy houses, and sturdy sea-going canoes. Wood, stone, and bone supplied their implements. They had knowledge of music and while they had no written languire children were educated in physical culture, history, especially that of their ancestors, courtesy, and "fair play". Are not some of these things worthy of emulation in our time? Especially respect for parents, courtesy, and "fair play"?

Few germs of disease could be carried by the Polynesians in their long voyages from the former home. In their paradise of islands they, therefore, never were sick with influenza, pneumonia, tuberculosis, measles, smallpox or other common infections and blood diseases. They had practically no diseases whatever until the coming of the white man. Even mosquitos and cockroaches were introduced by Europeans. In their original idyllic habitat the Polynesians died only of old age, accidents or violence. They had no experience with contagions and no inherited immunity to even common colds and measles. Contact with Europeans was quickly followed by epidemics, during which the natives died by the thousands. Formerly the natural increase of population was kept down only by the limits of the food supply, but the decimation of the natives by disease in the last 150 years has been appalling as the following figures show. In 1865 leprosy was introduced into New Caledonia where by 1888 there were 4000 lepers. In 1910 leprosy was brought into Nauru and by 1920 one in ten of the population was leprous. Respiratory diseases spread like a forest fire in dry weather among the natives, whose lack of developed immunity and habit of eating from a common dish often allowed the lung sickness to kill all of a family within a year following the infection of one of its members. Smallpox and measles were both deadly to the natives, who while coming down with such diseases would bathe in the ocean to cool their fevered bodies, and in part as a result of such ignorance, would perish. But Europeans showed a sad lack of sense about protecting the natives from contagious diseases. The natives were friendly, would offer to care for the sick, and catching the diseases themselves, often died as a result. For instance, in 1853 one child suffering from measles was landed from a missionary schooner and in Fiji alone the death of 60,000 natives in all was traced to this one child. In this case and in numbers of others piety was no substitute for knowledge and the good intentions of the mission workers did not always permanently benefit the natives. The Marquesas Islands have become depopulated, less than two thousand natives remaining, hardly one percent of their former numbers. On one of the Marquesas group there has been 100 deaths to one birth, the natives having become so discouraged by the complete wrecking of their world by contact with the whites that children are simply no longer born.

Contact with whites brought misfortune to Polynesia, not only from disease, but in the complete upsetting of the life of a people in the stone age by the complexities of modern civilization. Their manner of life, government, culture, religion, style of living, etc., was changed. Many could not survive such personal and psycho-

logical factors, became completely discouraged from inability to compete with the whites and preferred death of their race to becoming the salve or plaything of the rough seaman, traders, and plantation owners. Missionaries helped to eliminate cannibalism, a habit affecting only part of Polynesia, and in most cases tried to tide the natives over the period of transition, but in spite of such laudable efforts at least three-fourths of the Polynesians died between 1870 and 1920. Since then the decline has apparently been stopped and in some groups like Tonga and American Samoa an increase has taken place. Yet as late as 1919 influenza killed one-fourth of all the Fijian natives. Both the administrators and missionaries now know much better than a century ago or half century ago, how to handle and instruct the natives in order that only the evil and harmful things are eliminated and so that their culture may be interfered with as little as possible. In Tonga, Samoa, New Zealand, and Hawaii good results have been obtained. The natives have either accustomed themselves to European ways of life or are left sufficiently alone so that they remain contented. It is to be regretted that before Europeans learned how to teach and govern the Polynesians that so much harm was done, often inadvertantly.

Some Geographic Factors in Australia.

In Australia the natives had a low culture compared with the Polynesians and were soon exterminated or expelled from the sections of Australia favorable for settlement by the English. The Tasmanian natives indeed have all been dead for many years. In the Australian Commonwealth only 40,000 natives remain, too few to constitute a problem especially as those left wander in family groups over the desert interior and tropical northern territory. Factors that help account for the backwardness of development of the native Australian include: absence of plants and animals suitable for domestication, the lack of rivers and harbors that might attract natives of a higher culture into the continent, most of the southern and western coasts are desert as is also much of the interior, and the low stage of development attained by the natives who entered the continent that made them contented with a bare existence by hunting and gathering.

Of Australia's six and one half million people, 98 percent are of British descent, and over half live in the six state capitals, a remarkable urban concentration for a newly developed country. While Australia is mainly devoted to producing wool, beef, mutton, and wheat, the fertile areas are not evenly distributed but are concentrated in the east, southeast and southwest sections. Harbors are few and the exports and imports are concentrated in the developed ports which are also the capitals of their states. The railroads, made in different gauges which helps to retain a state's business for the state's capital, diverge from the six cities and the shop employees and management live there. The manufacturing plants, wholesale establishments, large retail stores, and the management of the colonial enterprises all center in the six capitals: Sydney, Melbourne, Brisbane, Adelaide, Perth, and Hobart. For every family getting its income from the activities mentioned two or three families gain support from service occupations, trades, etc., that exist because of the concentration of nearly all the political, industrial, and merchandising activities in a single city in each state, and help account for the remarkable urban concentration noted.

The commonwealth has adopted a slogan of "Australia for the Whites" and Oriental immigrants are strictly kept out. Since much of the continent lies within the torrid zone this policy requires the use of white labor to cut the sugar cane and do other hard physical labor under a tropical sun. High wages must be paid for this and the growing of cane sugar is made possible only by a protective tariff and bonuses. Whether the health of the white men suffers from this labor

in the tropics has not been determined because of the short time the whites have lived there. While the white Australia policy slows up the development of tropical Australia the country has decided on this policy and is unlikely to voluntarily change it. However, it results in a few thousand whites, thinly scattered across northern Australia, holding a million square miles of land probably a fifth of which would be productive in the hands of Orientals. The question whether a policy is wise which leaves a vast territory and rich resources almost unused and whether would be settlers from over-populated Asia can be permanently kept out, the writer will not attempt to answer Suffice it to say that the situation is a matter of genuine concern to thoughtful Australians.

Political Ownership

The Pacific Islands are owned or governed by several nations. Great Britian including Australia and New Zealand has mandates over the most territory. France is second in ownership. The United States, Japan, and Chile, which controls Easter Island only, are the others. However, the rich Netherland Indies include huge islands that total one fourth the area of mainland United States, lie between Australia and Asia, and form one of the richest colonial empires on earth.

To the industrial nations of the earth the "South Sea" islands furnish foodstuffs, raw materials and luxuries. Sugar, raised by plantation methods with introduced Oriental labor chiefly in Hawaii and Fiji, copra from the coral atolls and island coasts, and various small products like pearls, pearl shell, and the like enter world markets. Phosphate rock from desert isles, nickle, chomium, and some other metals from New Caledonia and gold from Fiji are the only minerals worth mentioning from the oceanic islands. However, Australia is very rich in coal, gold, zinc, lead, and other metals; New Zealand has gold and coal; Netherland India has great deposits of petroleum and tin; and the Philippines have gold and iron. All of these minerals are valuable materials for an industrial nation like Japan, that could use them to very good advantage. Let us hope that their ultimate control and utilization may be settled by appeals to reason and peaceful negotiation and not by application of brute force.

Pacific Trade.

The most important trade route has two branches that cross the northern Pacific basin from Pacific America to Japan and China, one goes close to the Aleutian group and the other via Hawaii. Lumber, flour, raw cotton, petroleum, iron goods and other metals, automobiles, machinery, etc., cross to the Orient, and raw silk, tea, soy beans, cheap textiles and many specialty products and cheap knicknacks are brought to America. This trade is generally beneficial to both Asia and North America. Other routes run from North America and Asia to Australia, New Zealand, and other south Pacific island ports. Ships from Europe reach Oceania via both the Panama and Suez canal routes and sometimes around Cape Horn or Cape of Good Hope. The trade to the south Pacific is essentially an exchange of manufactures for foodstuffs and raw materials. A minor trade route diagonals from Asia to South America. In recent years competition for Pacific trade has caused increased rivalry among the nations concerned and has led to strains in international relations. Wars, "incidents", quotas, tariffs, governmental regulations, trade and monetary manipulatios, and propaganda for national buying and self sufficiency have helped disrupt normal trade relations and have led to fear and ill feeling between the various Pacific rim races and nations.

United States Interests.

The interests of the United States in the Pacific began with the sending of trading vessels from New England to the Pacific Northwest to exchange Yankee notions with the American Indians for beaver and sea otter skins. Many of these furs were carried to China, where they were much in demand for decoration of the robes worn by mandarins. Enroute, the ships

stopped in Hawaii for refitting and to secure fresh water and food. Often a deck cargo of sandalwood was secured in Hawaii for China where it could be profitably traded. The tea, silk, and other goods, secured in China mae large profits for the ship owners on voyages that might last two years. The fastest sailing vessels in the world, the clipper ships, were developed in New England for the China trade via Cape Horn. The expansion of American whaling into the Pacific led to use of the Hawaiian Islands for an outfitting and repair center for the fleet. With decline of whaling, Hawaii turned to growing sugar and rice for the United States market aided by a reciprocity treaty. Investment of capital by Americans led to close relations and finally to annexation of Hawaii by the United States. Today Hawaii supplies the mainland with sugar and canned pineapple. The territory lies at the crossroads of the Pacific for steamships and airplanes, and forms the naval outpost for the defense of the Pacific Coast.

Forty years ago the United States secured the Philippine Islands from Spain, but our country could never make up its mind what to do with the group. Some wanted to exploit the resources of the islands, others to "liberate" the Filipinos. Finally the Tydings-McDuffie Act was passed which will result in an independent country of the Philippines by 1946 However, until the Philippines are completely established as an independent country the Un ited States has a problem to amicably maintain its prestige in the Far East, and the trade relations with the islands. The Independence Act provided for the progressive application of the American tariff to Filipino products, and appears to have passed by non-expansionists combining in Congress with senators and representatives from the beet and cane sugar states, from growers of hemp and makers of cordage, and from cotton and dairy states who wanted to eliminate competitions from Filipino sugar, Manila hemp, and coconut oil, the latter used for dairy substitutes and soap in place of cottonseed oil, butter, and animal fats. Such a policy would compel the Philippines to seek markets in Japan and would injure our export trade materially, since the islands could hardly afford to buy our goods. Fortunately, however, Congress has modified the original treaty and has arranged a reciprocity agreement similar to our arrangement with Cuba that should insure a continuation of our mutually profitable trade with the Philippines.

Lately the aggressive expansion of Japan has made some Filipinos wonder of they were wise in requesting independence and it is possible the original tydings-McDuffie Act will be further modified. At present the United States agrees to withdraw from army ports in 1946 but the question of naval bases has been left open.

Japan and China.

Outstanding world problems exist in the Pacific area. Japan, a country the size of California, with half as numerous a population as the entire United States has turned to manufacturing in order to maintain her growing population. Japan has entered markets formerly monopolized by Europe with resulting disturbances to trade. Furthermore, Japan's industrial foundations are weak since the country lacks cotton, oil, rubber, adequate iron and other metal resources and has insufficient coal. With a strong belief in its destiny Japan has begun to encroach on China and to threaten other of its neighbors. Japan secured some iron and coal in Manchuria but in northern China in Shansi, Shensi, Kansu and Chihli are nearly 750 billion tons of high grade coal and some iron, besides other resources, hence Japan's interest in this region. In China ,the Philippines and Netherlands Indies are found most of the vital necessities for manufacture and world trade that Japan lacks. While we may sympathize with Japan's problems of over-population and lack of natural resources it seems open to question whether the course the

leaders of Japan are now taking was the only possible solution and whether the country's needs for materials and markets might not have been solved by peaceful negotiation and understanding.

Human factors resulting among other things, from Emperer worship, dominance of the army and navy in public affairs, recent emergence from fuedalism and perhaps both an inferiority and superiority complex are probably more important than natural factors in influencing the present course of Japan in China.

China, inhabited by one of the world's oldest races, but so poorly organized that some authorities hesitated to call it a nation, a few years ago showed evidence of the development of a national spirit that should have led to the creation of a powerful modern states. Unfortunately before the process of modernizing the government and people of China had been more than well begun, the land has become involved in horrible waste and ravaging by hostile invaders. Apparently the winning of the war in China, or "incident" if you prefer the term, now in its third year, will depend on which people, Japanese or Chinese, possess the most staying power. Whatever the final ending will be of China's troubles, it is safe to predict that Europeans and Americans in China will never find life and trade there the same as before the war started, but must adapt themselves to changing conditions and be willing to deal with Orientals, on the basis of equality rather than to continue to assume that domination by the white races is ordained by God.

Some Oriental Problems.

England, France, and the Netherlands, are the chief European owners of colonies in southeastern Asia, and in addition have made large investments in China. Both the investments and colonies are threatened by the ambitious Japanese. To the north Soviet Russia controls a vast territory in Siberia touching on the Pacific, that is favored by very large and important natural resources. Russia and Japan for half a century have been rivals for the political and economic control of Manchuria and northern China. The Russian-Japanese War did not permanently settle this rivalry and many border conflicts have taken place during recent years, that may be the preliminary incidents leading up to another war. Perhaps Stalin is waiting until Japan is exhausted from her efforts to conquer China before he cares to have Russia at war with Japan. Conflict of interests regarding oil in Saghalien and of fishing rights off Siberia are other possible causes for trouble between Japan and the Soviets.

The outbreak of the war in Europe has further complicated the situation between European powers and the Japanese and other people's along the Pacific rim of Asia. It would take a bold prophet to forecast what will happen in this part of the world during the next few years. It is safe to declare, however, that the past political geography of the Asiatic countries bordering the Pacific is likely to undergo profound changes in the immediate future.

In the Pacific Area races are in conflict, trade is disturbed, political boundaries are likely to change, events of world importance are taking place. To the writer it appears that the United States should continue by every peaceful means to maintain the "open door for trade", that we may properly protest against the willful invasion and destruction of peaceful lands, that by loans and other lawful means the weaker and innocent may be aided, that we may prepare for the defense of our land, but that actually military intervention between belligerents in Asia would be so unwise that it should never even be seriously considered.

The Pacific area has wonderful resources and great possibilities of expansion and development. Let us hope that peace and good-will in Pacific inatrnational relations will become the basis on which the future of the region will be built.

Early American Geographies

By JAMES F. CHAMBERLAIN

As teachers of geography, we are prone to believe that the subject is not well taught in the United States, and that progress is slow. This is because our thought is focused upon high and constantly advancing standards, while we are unmindful of the level from which we started. Although the teacher is superior to the text, the fact remains that in geography, as in other subjects, progress depends, in large measure, upon the book. A careful consideration of early American geographies will enable us better to understand the growth of our subject, as well as the development of our country.

One of the first concerns of the American colonists was for education, and schools were very early established. Many of these were known as "Dame Schools" or "Kitchen Schools", because they were conducted by housewives who had the time and the inclination for the work. Texts were few and were, of necessity, imported. Naturally the geographies published in Europe gave scant attention to what is now the eastern part of the United States. This was a source of increasing dissatisfaction to American educators, with the result that educational independence quickly followed national freedom, and American texts supplanted those written abroad.

It is an interesting fact that geography found a place in academies and colleges before it did in the common schools, because the subject was not thought to be adapted to children. In 1751, through the efforts of Benjamin Franklin and others, there was founded in Philadelphia, Franklin's Academy, the first well-known American institution of its kind. This academy, which developed into the University of Pennsylvania, included geography in its course of study. Columbia College, now Columbia University, offered geography as early as 1754. Harvard was teaching the subject in 1794, and Dartmouth two years later. The first public high school to appear, the "English Classical School" in Boston, was opened in 1821, with geography as one of the subjects of study.

Among the geographies imported from England was William Guthrie's: "A New System of Modern Geography; or A Geographical Historical and Commercial Grammar and Present State of the Several nations of the World." This work was first printed in London about 1718. The first American edition, of which the present writer has a copy, was brought out in Philadelphia in 1794. It is in two leather-bound volumes, of encyclopedic proportions. Not a map or a picture enlivens the pages of either volume, but there is a diagram showing the relative position of the planets with respect to the sun. The absence of the two outermost is explained by the fact that they had not then been discovered.

Very much space is given to history, government, education, religion, and so-called curiosities. The United States is presented as a whole, and then as individual states. On page 579 of volume two we read: "Indiana, so-called, is a tract of land lying on the Ohio River, in the state of Virginia . . ." In connection with California, which was then a part of New Mexico, the following statement appears: "In California there falls in the morning a great quantity of dew, which, remaining on the rose leaves, candies, and becomes hard like manna, having all the sweetness of refined sugar, without its whiteness." p. 484.

Nearly one-fourth of volume one is devoted to England, and each of the other divisions of the British Isles is given much space. There are occasional touches of cause and consequence, such as the following: "It (the sea) prevents the extremes of heat and cold to which other places, lying in the same degrees of latitude, are subject." p. 219.

The American edition of Guthrie's geography was for general readers, rather than for students, although it was used in colleges. It was published on the subscription plan, and the names of all subscribers appear in volume two. Among them are George Washington, Mrs. Washington, Lawrence Washington, De Witt Clinton, Samuel Otis, Jedediah Morse, and many other familiar names.

In 1809 there was printed in New York, the first American edition improved. The work was in two volumes, but much smaller than those of the first edition. The importance of maps was recognized, for 25 appear, although there are no illustrations. Volume one treats of Europe, the presentation being very largely descriptive. In volume two the other continents are handled. Australia, then called New Holland, was given little attention. The map shows the Mississippi River as the western boundary of our country.

As might be expected, some of our early geographers were ministers, for many ministers were teachers. Jedediah Morse, a Congregationalist clergyman, of Charlestown, Massachusetts, is known as the "father of American geography. "After graduating from Yale, he spent two additional years in preparation for the ministry, during which time he worked on what was to be the first American school geography, "Geography Made Easy," published in 1784. The present report has to do with the edition of 1807.

The text was dedicated "to the Young Masters and Misses Throughout the United States." In the preface, called the "Advertisement", the author laments the fact that Americans know so little of the geography of their own country, saying: "In the following sheets, the author has endeavored to bring this valuable branch of knowledge home to common schools, and to the cottage fireside. . . . He has endeavored to accommodate it to the use of schools, as a reading book, that our youth of both sexes, at the same time they are learning to read, might imbibe an acquaintance with their Country."

Geography Made Easy is a substantially bound book, 4½" by 7" in its overall dimensions, and therefore too small for other than folded maps. It contains a map of the world, and one of North America, but no pictures. The order of presentation is: Astronomical geography, North America, the United States, other continents and countries. As nearly one-half of the space is given to the United States, other parts of the world are, of necessity, treated briefly. The concept of geography, as a description of the earth, is adhered to. No reasoning is required, and there is nothing to create interest in the minds of pupils.

How imperfectly our country was known in those days is shown by the following: "North America, although an uneven country, has no remarkably high mountains. The most considerable are those known under the general name of the Allegheny Mountains. These stretch along in many broken ridges under different names from Hudson River to Georgia. The Andes and the Allegheny Mountains are probably the same range, interrupted by the Gulf of Maxico." p. 38.

The description of each country and state is introduced by giving its dimensions, latitude. longitude and boundaries. The United States is first presented as a whole, and later by individual states. History, education, religion, and government are emphasized. So fully are the animals, birds, fish and snakes of our country described, that 23 pages are required.

In speaking of the products of New England Morse says: "Apples are common and in general plenty in New England and cyder constitutes the principal drink of the inhabitants." p. 109. The early New Yorkers had their water problems, for the text states: "A want of good water has been a great inconvenience to the citizens; there being but few wells in the city. Most of the people are supplied every day with fresh water conveyed to their doors in casks from a

pump at the head of Queen Street, which receives it from a spring about a mile from the center of the city. The water is sold commonly at three pence per hogshead at the pump." p. 174.

In 1789 Morse published his second text, "The American Geography," on which he spent four years. His information was secured through travel, correspondence, and the suggestions of people in the several states, to whom the manuscript was submitted. The author expresses his dissatisfaction with the books then in use, saying in the Preface: "Europeans have been the sole writers of American geography, and have too often suffered fancy to supply the place of facts, and thus have led their readers into errors, while they professed to aim at removing their ignorance."

The first few pages in volume one are devoted to astronomical and physical geography. It is interesting to note that the total number of stars was estimated to be 3,000, while the estimate of present-day astronomers runs into billions. Interesting, also, is the definition of climate: "A climate is a tract of the earth's surface included between the equator and a parallel of latitude or between two parallels of such a breadth as that the length of the day in the one be half an hour longer than in the other." p. 7.

Although all countries were presented, about four-fifths of the total space was given to the United States; such important countries as Germany, France and Italy, receiving little attention. Each of our then-existing states, was given individual treatment. There are two maps of our country, but because they are folded, the inconvenience in using them was considerable. In common with most early texts, there are no pictures. The causes and events of the War of the Revolution are given in detail, as are daily events in the life of Washington.

The text tells us that: "Hudson's River is one of the largest and finest rivers in the United States" p. 243 and that: "The Natural Bridge is the most sublime of Nature's work." p. 368. We read that the number of vessels entering the port of Philadelphia in 1787 was 870, and that among its exports were spinning wheels, snuff, hair powder and sperm candles.

Think of the present internal commerce of the United States, and the part played by the Mississippi River in that connection, in the light of this statement: "The merchandise necessary for the commerce of the upper settlements on or near the Mississippi, is conveyed in the spring and autumn in batteaux, rowed by eighteen or twenty men, and carrying about forty tons. From New Orleans to the Illinois the voyage is commonly made in eight or ten weeks." p. 41.

In this text Morse occasionally shows the relation between geographic factors and human affairs as is shown when he speaks of New York City. ". . . its convenience for internal commerce is singularly great. The produce of the remotest farms is easily and speedily conveyed to a certain and profitable market and at the lowest expense. In this respect, New York has greatly the advantage of Philadelphia." p. 244.

In 1790 the American Geography became "The American Universal Geography." This new work was in two volumes, the first of which presents the western hemisphere, while volume two is devoted to the opposite hemisphere. Later editions of this work were much improved by the inclusion of many maps, and a complete index. In spite of this, the books were not well adapted to school use, although prescribed for academy and college students.

Morse considered geography an important factor in the education of children, and in 1795 he published his "Elements of Geography," which for many years practically monopolized the field, and passed through many editions.

In 1795, Nathaniel Dwight, then but 25 years of age, published a text under the title: "A Short but Comprehensive System of the Geography of the World: by Way of Question and

Answer." Dwight was a minister and physician, but he was much interested in education. He believed that the book should answer its own questions, as is shown by the following typical illustrations: "Q. What curiosities are there in France? A. A fountain near Grenoble emits a flame which will burn paper, straw, etc., but will not burn gunpowder. Within about eight leagues of the same place is an inaccessible mountain in the form of a pyramid reversed. Q. What curiosities are there in Portugal? A. There are lakes into which a stone being cast causes a rumbling like the noise of an earthquake."

Another geography for elementary schools appeared in 1810 when Elijah Parish, a Congregationalist clergyman, published a text, "New System of Modern Geography." Judged by the titles, each author had "a new system". The book has neither maps nor pictures, and like many of the contemporary texts, the overall dimensions are so small that it was not practical to insert maps.

Although all of the countries of that day are presented, our own was given the lion's share of the space. The order of presentation is: astronomical geography, physical geography, North America, the United States as a whole, the individual states, other countries.

In the Postscript, Parish expresses his belief in geography as a moral force, saying: "That the youth of the United States may find such information in the volume as will enlighten the understanding and prompt the moral culture of the heart, has been the study and anxous desire of their cordial friend, the Author."

Much space is given to the description of rivers, lakes, bays, bridges, canals and roads or turnpikes, as they were called. The need for roads is shown by the following: "Companies are incorporated to extend a turnpike to Pittsburgh nearly 300 miles from Philadelphia." p. 94.

Later Parish wrote a book entitled: "A Compendious System of Universal Geography", and in 1813 he published one called "Sacred Geography." In addition to his other work, he gave assistance to Morse. Like most of our early geographers, Parish was an educated man, being a graduate of Dartmouth.

J. A. Cummings of Boston was the author of several books, chief of which was his "Introduction to Ancient and Modern Geography", first published in 1813. This book passed through several editions, and was used in Harvard's entrance examinations and in several colleges. It was intended for general readers, as well as for students. There are no maps, no pictures and no table of contents. This report is based on the edition of 1820.

In the Preface we read: "The length and breadth of countries are, for the most part, omitted. This may be thought a defect. But it is more important that a child should know the comparative extent of states and countries than to learn their exact length and breadth in miles." The author's faith in the power of the map was almost unbounded, as shown by the following statement, taken from the Preface: ". . . boundaries, if taken from the map, cannot but be recollected, and if faithfully studied two or three times over, a picture of the earth's surface will always be distinct and familiar to the mind."

As in other texts of that time, the treatment is descriptive, and the space given to each country is small. All questions, there are 38 pages of them, are at the back of the book. The questions quoted are typical. "What two rivers run into Albermarle Sound? p. 269. What river rises near Lake Michigan and runs into the Mississippi? p. 270. What is the most easterly cape of North America? p. 256. Which way is Switzerland from Italy? p. 262. What are the air and soil of Italy? p. 280.

In describing the Appalachian Mountains Cummings says: "These are, in some places, immense masses of rocks, piled one above another, in frightful precipices, till they reach the height of more than 10,000 feet

above a level with the ocean." p 34. We are reminded of the development of California when we read that its principal towns are Monterey, San Diego, San Gabriel and Santa Barbara.

The author's vivid description of the mael-strom must have filled with terror the minds of many children for he says: "The body of the waters that form this whirlpool, is extended in a circle about thirteen miles in circumference. . . . No skill in the mariner, no strength of the rowing, can work an escape; the sailor at the helm finds the ship at first to go in a current opposite to his intentions; his vessel's motion, though slow in the beginning, becomes every moment more rapid; it goes round in circles still narrower and narrower, till at last it is dashed against the rocks, and instantly disappears. Nor is it seen again for six hours, till the tide following, it is thrown forth with the same volume, with which it was drawn in." pp. 216-217.

Daniel Adams, of Townsend, Massachusetts, was born two years before the opening of the War of the Revolution. At the age of 24 he was graduated from Dartmouth. In 1816 he published: "Geography: or a Description of the world." Part I, "Geographical Orthography", consists of several pages of place names. This material furnished the basis for spelling lessons. Part II, "Grammar of Geography", is introduced by definitions, followed by a brief description of the forms of land and water, the cities and larger political divisions of each country. This part was to be committed to memory. There are many pages of map questions to be answered by the pupils. All quotations given in this paper are from the edition of 1828.

Almost without exception, the questions draw upon the memory only, affording little stimulus for interest or individual study. In referring to these questions the author says: "It will not be sufficient that the pupil for *once* is able to answer these questions; they ought to be put to him by his Instructor, *repeatedly*, from time to time, till the answers shall become as familiar to him, as the numbers of his multiplication table." p. 9.

Part III, "A Description of the Earth", is an amplification of the second part, with the addition of climate, products, commerce, government and other topics. The author states that this part is "designed for reading in private, or by classes in schools". Adams' text carries 10 pictures, but there is no reference to them. There is also a table of contents, and there are directions for map projection.

As we read the following excerpts we realize how conditions in our country have changed since the book was written. "Vessels are from five to thirty days on their passage up to New Orleans, 87 miles; although with a favorable wind they will sometimes descend in 12 hours." p. 102. Of Detroit, Adams says: "It is a place of considerable trade, which consists chiefly in a barter of coarse European goods with the natives for furs. The streets are generally crowded with Indians in the day time; but at night they are shut out of the town." p. 166. Chicago is not mentioned, and Kaskaskia, the first capital of the state, is given the leading place. The petroleum industry in our country is foreshadowed by the statement: "There are many springs called *oil springs*, where Petroleum or Seneka oil is gathered in great abundance." p. 166.

William Channing Woodbridge, another early American geographer, was a graduate of Yale, a minister and a teacher. As a traveler in Europe, he gathered much information which he used in the preparation of his texts, the first of which, "Rudiments of Geography on a New Plan, Designed to Assist the Memory by Comparison and Classification." was published in 1821.

Encouraged by the success of this book, Woodbridge, assisted by Mrs. E. Willard, brought out, a few years later, a text called: "Universal Geography, Ancient and Modern". I quote

from the sixth edition. The book was intended for use in academies. It has numerous illustrations, but no maps. The material and the order of arrangement, are similar to those in the earlier book. The following is illuminating as to transportation facilities: "The most important post road in the United States, is that which traverses the states on the Atlantic, a distance of 1800 miles, passing through all the principal towns, from Robbinstown in Maine to Florida. A plan has recently been invented for constructing roads with iron bars, or railways, on which the wheels of carriages run so easily, that they may be drawn from 15 to 30 miles an hour, by means of locomotive steam engines. Railroads are now considered even more useful than canals, and are building in every part of England. In the United States, within a few years, a large number of railroads have been made or projected." p. 240.

Apparently geography appealed to Congregationalist ministers, for another one, Rev. Charles A. Goodrich, ublished, in 1827, a text entitled: "Outlines of Modern Geography, on a New Plan, Carefully Adapted to Youth." The book consists of 240 pages of closely printed questions and answers. The answers were to be committed to memory by the pupils. As was customary, the text is without maps; an accompanying atlas being supposed to remedy this deficiency. The book shows an advance over most of its competitors, in that there are a large number of cuts, but the attention of the pupils is not directed to them.

The order of topics is: mathematical geography, explanation of maps and globes, political geography. As usual, government, education and religion are strongly featured. The presentation of each state or country begins with the question: "How is it bounded?" The boundaries are, of course, to be memorized. The book closes with many pages of review questions, to which pupils were to recite the answers. In this connection the author says: "It would be convenient for teachers to keep by them written answers to all questions in the following review." p. 229. Apparently the children were expected to have greater mastery of the subject than were the teachers, for we read: "The pupil will make out his own answers, as far as possible from memory, and the rest partly from the book and partly from the atlas." p. 229.

Samuel Goodrich, whose pen name was Peter Parley, was a brother of Charles A. Goodrich. He was a prolific writer, although it was said that he was not the author of all of the Perter Parley books. Parley's books foreshadowed the geographical readers of a later day. In order to arouse the interest of children, he used the story-telling plan, and to some extent rhymes.

In 1827 he published, "Tales of Peter Parley About North America." and ten years later "Grammar of Modern Geography". The latter contains a dozen maps and 96 pictures. Although, in the Preface, Parley emphasizes the importance of education through the eye, the attention of the children is not called to the illustrations. He believed that geography should be used to teach moral lessons, saying in this connection: "The heart is as capable of being taught as the intellect, and happiness depends much more upon its proper and right cultivation, than upon the cultivation of the mind." Preface.

The following is a bit of a rhyme taken from the text:

"The world is round and like a ball
Seems swinging in the air;
A sky extends around it all,
And stars are shining there.

Geography goes high and low,
To set them forth and show them;
The more attention you bestow,
The better you will know them."
pp. 15-16.

As a boy, Jesse Olney was very fond of geography, and in manhood he was a successful teacher of the subject. His text, "A Practical System of Modern Geography", published in 1828, began with things and

conditions with which children are familiar, and proceeded to the unknown. Later editions of the book, carry a few maps and many pictures.

In the Preface we read: "The introduction of geography into common schools, as a regular branch of education, has, of late years, become nearly universal. Formerly, this science was taught only to the higher classes, it being thought by most teachers, that the pupil must be well advanced in other branches before he could study this to advantage."

In speaking of geographies for children, the author says: "Most of them begin with definitions, which to be understood, require a degree of knowledge on the subject, never possessed by the new beginner. Children, instead of being made to commit definitions to memory, should, as possible, at the beginning, be taught by means of the eye; and hence the use of maps, pictures, and diagrams, in teaching infants. The map is to geography, what orthography is to the art of reading . . . the map, then, ought to be the first lesson in geography, for by its means, the child can locate his ideas, and can see at a single glance, the situation of the places. the names of which he learns."

Much space is given to the United States, the study of which begins with the home town, followed by that of the county and then the state. The geography of each state begins as follows: "How is it bounded? What is its capital?"

James G. Carter, of Massachusetts, a contemporary of Horace Mann, did much for the professional training of teachers, and for education in general. In 1830, in collaboration with William H. Brooks, another well-known educator of that day, he published "A Geography of Massachusetts for Families and Schools." So far as known by the present writer, this was the first text devoted to the geography of a single state.

The book was based upon the inductive method of teaching, and therefore all cities and towns in the state, as well as all counties, are presented. The pupils began their work by studying the home town, from which they moved outward to other areas. Although the material is largely descriptive, there are many illustrations of the relations between geographic environment and human affairs. General review questions complete the study. In the last 10 pages, there are definitions of the terms used in the text.

In the Preface the authors state: "This is a branch of learning, which has been more neglected, than its importance deserves; whether we consider the value of the knowledge obtained, or whether we consider the adaption of the study to the early development of the mind."

That the Boston of 1830 was beginning to acquire great importance as an industrial center, is indicated by the following: "Within a few years, commerce having become less flourishing and profitable, a considerable portion of the immense capital of Boston, has been withdrawn from navigation and invested in manufactures. The miraculous influence of the treasures of capitalists, has created factories and gathered busy villages round the numerous water-falls of the interior, both in and out of the state; at Waltham, Springfield, Somersworth, Dover and Lowell, and many places beside." pp. 129-130.

Time does not permit of the discussion of the many other geographies published during the period between 1784 and 1830, but they are very similar to those to which reference has been made.

Some Locational Problems in British Industry

By ELIOT G. MEARS
Leland Stanford Jr. University

The following observations on British industry were based upon my year abroad in 1937-38 and may prove of interest not only in considering the problems there but also their meaning to other countries. The measures taken by the government and private interests are indeed striking, but they do not represent what we might construe as radical changes in the geographical principles of factory location. The practices, however, in view of the fear of possible military attack, may not appear as primarily geographic in their concept; yet, in my opinion, none of them can be divorced from the broad question of land use.

Where are manufacturing plants located? The normal list of factors includes those of sources of supply, power, labor, markets, capital, and other pertinent features wisely stressed by engineers and private firms. These components are active and dynamic. But we cannot keep abreast of the times if our thinking stops with the foregoing economic and efficiency gauges. There are other considerations of vital consequence which are often heavily discounted or altogether omitted from discussions. Onerous taxation burdens levied by national, state, and local authorities are tending to overweight the financial administration of industry within the management sphere, as exemplified by the incidence of taxes based on tthe factory buildings or on earnings, the legislation regarding wages, and interregional competition. Most of these forces, likewise, operate directly or indirectly within the scope of social and public activity.

In addition to the more strictly economic and engineering aspects, we are becoming clearly aware of the implications which derive their influence from a new viewpoint toward financial and social questions, particularly housing, health, transport, and labor. In the United Kigdom, for example, the regional contrasts are clearly recognized. That the situation is regarded as a distinct menace, from several points of view, is evident in the following Resolution of the House of Commons (November 18, 1936), appended to the official questionnaire for foreign persons desirous of setting up manufacturing establishments:

> That, owing to the serious decline in the recognized industrial areas of many major exporting industries upon which the preeminent commercial position of this country was built, this House is of the opinion that steps should at once be taken to prevent further industrial concentration around London and in the South by diverting new undertakings to those areas where unemployment and under-employment have for long caused hardship and distress among industrial populations.

In the past, the prime locational factors have been raw materials, power, labor, capital, and markets, with an increasing tendency toward markets as the main motivation. In any study, however, the part played by transport is usually of first rank, despite its submergence and the apparent disappearance under some of the factors which I have enumerated. If the future location of workshops were to be governed entirely by considerations of private economy, untrammeled by any other, the problem of determining a satisfactory location would be relatively easy. The realistic aspect of our problem, however, makes political bodies consider other than purely economic motives. Thus, conscious effort has been made in Great Britain to encourage firms with foreign capital to locate in the Special Areas and in the other depressed industrial districts. Furthermore, there is a clash of national interests, for the London Metropolitan Area offers probably the best business opportunity for numerous kinds of new enterprises; yet

that region is exceedingly vulnerable from a military standpoint.

Then there is the question of state socialism. Should Government permit industry to locate when and where it will? More than ever before this question is being raised. In Germany, for sometime, the strategic as well as the economic phases have been receiving the most careful consideration. The student of history might conclude that England and the English would be the last stronghold against an ordered plan and program, such as the adoption of a system of licenses; yet the present conservative Prime Minister, formerly the Chancellor of the Exchequer, has stated that he saw nothing revolutionary in prohibiting enterprises from functioning in certain areas, since this was merely an extension of the established practice of zoning in town and country planning. A return to somewhat analogous practices in Elizabethan times has found a more positive supporter in Sir Malcolm Stewart, Commissioner for the Special Areas of England and Wales, who stated, in his Third Report (1936), that while he did not believe it possible to compel either existing or new industries to go to a predetermined locality, nevertheless an official policy of refusal to permit industries ot settle in specified places was, in his judgment, not objectionable.

The promoters of new enterprises in Great Britain are now required to consult separately with the Home Office, the Ministry of Labour, the Board of Trade, Special Areas, and other governmental departments. Although the President of the Board of Trade has expressed himself strongly against the introduction of other than economic considerations, public attention is now being directed toward the use of permits and special licenses in preventing additional industries from locating in Greater London and the other more strategically vulerable regions. The Royal Commission on the Geographical Distribution of the Industrial Population, which has been holding public hearings since October, 1937, has been giving such possible developments a great deal of attention. These changing problems are due principally to the speeding up of transport and communication, exemplified most clearly by the conquest of the air. While the locus of an industrial plant must be designed with reference to the areas of raw materials, power, labor, and other considerations, the focal location with regard to these factors *plus* the military requirement has come strongly to the fore.

During the period of the Great War, and of reconstruction, depression, partial recovery, and rearmament which have followed, there are five outstanding features of the locational problem. In the first place, the most notable change in factory location since the Great War has been the strong emergence of strategic factors, in contrast to the normal emphasis upon economy and efficiency. The danger of attack, the desire to camouflage industrial establishments from public view, and the treatment of accessibility as an objectionable rather than a favorable feature are some of the immediate considerations. One might almost be justified in stating that what was formerly regarded as the most economical location is now regarded as undesirable. In other words, the unsettled state of world affairs has discounted heavily the most favorable geographical situation as a logical one for the development of industry and commerce. Furthermore, there is now the social feature, owing to the number of unemployed and the plight of the depressed areas. The government offers subsidies in certain instances when firms will transfer their operations to those centers of population where the means of livelihood are exceedingly scanty.

Another significant development is the increasing concentration of population in the London area, and to a lesser extent in other large population centers. Statistics are stiking The Registrar-General's figures for 1931-36 indicate that during that period the population of England and

Wales gained 851,000. London County lost 264,400, and Outer London gained 602,522, so that the net increase for Greater London was 338,122. Hence 71% of the gain in the total population of England and Wales was attributable to Outer London; or, expressed more simply, during the five-year period the population of Outer London gained 602,522, whereas that of the rest of England and Wales had a net gain of only 248,478 persons. In 1931, out of a total population of 40,000,000 in England and Wales, one person in every five was a resident of Greater London.

Third, a great deal of publicity has been given to the alleged migration of industries from Scotland and northern England to the south. A study of official statistics of employed workers from 1923 to 1936, together with personal observation, makes it evident that the amount of such migration is surely not large, and the change that has taken place has been mainly in the initiation of lighter industries in newer industial centers. During that period there occurred a diminution in employment of 47% in coal mining, 21% in shipbuilding, and 20% in textiles. Contrasted with this was an increase in workers of 62% in motor vehicles, 33% in hosiery, and 20% in carpets. What has taken place is that the newer centers of industry, in Birmingham, London, and the south of England, cater to the consumer markets and characteristically are to be classified as light rather than heavy industries—for example, automobile plants, printing firms, bakeries and laundries, brickmaking, wood working, and the building trades. Actually, few establishments of this type have been started in recent years in the northern half of the British Isles. On the other hand, there has been little population growth in the mining and heavy industries districts. It is an entirely wrong conception, therefore, to state that there has been any important geographical migration of industries from north to south in recent years.

Fourth, the history of British industry shows clearly its outstanding dependence upon location of coal deposits. The notable textile, shipbuilding, and iron and steel plants have been located on or near the coal fields. That situation still holds true. We are all cognizant, nevertheless, of the changed position of coal as a basic commodity owing to the development of substitutes in various uses. Coal production, which in 1913 was 287,000,000 tons, had shrunk to 243,000,000 tons in 1925, and to 240,000,000 tons in 1937. In those same years foreign bunkers required 21,000,000, 16,500,000, and 11,500,000 tons respectively. Water power, petroleum in many other countries, and the system of electric supply known as the "grid" have been important factors in bringing about the reduced utilization of coal.

Nationalism is the final important consideration. There are many aspects to this significant and growing phenomenon, noticeable in practically all countries. The situation has become especially serious since the importance of Great Britain in world affairs has depended, and still does, upon a natural flow of commodities and services to and from other countries. The erection of tariff barriers, import restrictions, and political planning have resulted in a change in the type of incoming commodities and correspondingly of outgoing exports. The increasing emphasis upon domestic trade in contrast with foreign trade was made clear in the Balfour Report on Industry and Trade (1926), among the effects of which may be noted the recent development of interior sites and the growth of industry away from the seaboard. In the valuable study being made by the Royal Commission dealing with the geographical distribution of industry, suitable attention has been called to this feature of nodality with its prenomenon of transferring industry to interior points in order to cater to the home population. One of the most striking developments in Great Brit ain has been a more overt utilization of the regional and locational approach in dealing with questions of industrial location.

The Origin of the Valley of June, Gull, and Silver Lakes (Horseshoe Valley), Mono County, California *

By JOHN E. KESSELI

The valley of June, Gull, and Silver lakes is located ten miles to the south of Mono Lake. It is noteworthy on account of its shape in plan which resembles a horseshoe. This singular shape has been ascribed by I. C. Russell to a glacial modification of drainage. In his view two originally northward draining valleys were joined in their headwater areas through a glacially conditioned reversal of stream flow in the eastern of the two valleys. It can be shown, however, that a reversal of drainage in the way suggested by Russell did not occur. Glacial erosion can not explain the evolution of Horseshoe Valley, nor were processes of faulting involved in its formation. The valley is clearly the product of stream erosion and was essentially completed prior to the advent of glaciation. The shape of Division Butte (Reversed Peak) which rises within the horseshoe indicates that the valley started as the incised meander of a stream which, coming from the north, traversed Horseshoe Valley from west to east, i. e. in a direction opposite to the present direction of drainage. The development of the valley through combined lateral and downward erosion was followed by a period of single downward erosion which cut a narrower valley, 600 feet deep, into the bottom of the former meander. The marked change in erosive behavior is here attributed to a loss in volume of the river. Since the reduction in volume was associated with a marked increase in erosive power, as shown by the hanging tributary valleys, it is best attributed to orogenic processes which caused the loss of a part of the headwaters while simultaneously increasing the rate of corrasion. A last relative uplift along the eastern Sierra fault then isolated the valley and through tilting reversed its drainage. The further deepening of the valley, negligible in the eastern arm but amounting to 400 feet in the western arm, is found to be in harmony with today's drainage but in marked disharmony with the flow of ice of Pleistocene Rush Creek glacier which entered the valley from the southwest and sent a branch through each of the two arms of the horseshoe. The deepening is therefore attributed to preglacial stream action. Glacial erosion is only credited with minor modifications, as the formation of the basins of Silver and Gull lakes. June Lake, the largest of the three, however, is due to damming by lava flows. A comparison of Horseshoe Valley with Yosemite Valley suggests that all events involved in the formation of the former took place during the Pliocene epoch.

[1]See U. S. G. S. Mt. Lyell quadrangle.

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Cerros de Trincheras in the Papago Country or Arizona

By J. W. HOOVER
Arizona State Teachers College

From the standpoint of occupance the Papago Country is marginal, since it is essentially desert in character. Prehistoric culture in the region has been obscured, since construction then as now was largely ephemeral, and village sites soon lose their identity for the occurrence of potsherds. More conspicuous are a number of fortified hill sites with defense walls, and rock terraces for house sites, known as *cerros di trincheras*.

The Papago country of Arizona is peripheral to the drainage basin of the Madgalena River of Sonora in which trincheras construction was furthest advanced and on grandest scale. At the present time seven examples of *cerros de trincheras* are known in the Arizona Papagueria. The cerro de trincheras at the Mexican village of Trincheras may be considered the classic example. The terraces begin at the base of the hill and continue to the summit and partly down the opposite slope. In height they measure from several to eight or nine feet. The walls are filled flush behind with angular rubble making flat benches averaging fifteen or sixteen feet in width.

The occurrence of the same structural elements in the Arizona trincheras sites, suggests that the latter are of the same culture if not of the same people, although peripheral outliers. These elements, which occur in varying proportions and arrangements according to the importance and morphology of the sites are: (1) Walled terraces filled flush for defesive house sites; (2) Cross walls on some of the above, suggesting rooms; (3) Low circular walls of small diameter, evidently house sites; (4) Breastworks of low roughly constructed walls across vulnerable slopes or approaches; (5) Plazas enclosed by low stone walls whose situation would suggest ceremonial or social use and not defense; (6) Universal occurrence of red-ware potsherds similar to the plain ware used by the Papago Indians today. Types of construction and their arrangement on the hill sites, in Arizona, even more than in Sonora, are so indicative of the defense motive that any other appears absurd.

Typical of the Arizona trincheras is "Echtoy-ki", the middle one of three basaltic hills five and one-half miles northwest of Sells, and another "cerro" one and one-fourth miles southwest of Echtoy-ki. From the character of these buttes, as well as of others in the area, it is evident that the trincheras builders preferred buttes of small summit area which were bounded largely by cliffs and steep rugged slopes easy to defend.

On the saddle at the east and west ends of the knoll-like summit of Echtoy-ki, house site terraces give way to purely defense walls, which reach their greatest height and thickness at points most vulnerable to attack. They cross the saddle directly and continue down the slopes on both sides across the lines of probable attack instead of along the contours.

Five lines of defense walls guarded the settlement southwest of Echtoy-ki. The major portion of the village was between the fourth and fifth walls. The slopes are steeper both above and below, and the walls extend along the steepest places. A few house sites above the fifth wall were of larger and better construction, possibly for a preferred class.

A few miles east of the Papago Indian village of San Miguel is a larger cerro de trincheras. The arrangement of walls and house sites here is remarkably similar to that on the butte southwest of Echtoy-ki, but on a larger scale. Other trincheras in the Papago Country are on a smaller scale and merely repeat the elements which occur in the others.

The trincheras builders in all probability built pithouses where the conditions permitted. But on the rock

surfaces, excavations were impossible and the rock wall enclosures may have been a substitute. The most important trincheras constructions are on north slopes in the Papago Country, but the choice of slope was evidently not motivated by temperature conditions, but by morphological conditions only as related to defense.

It is reasonable to suppose that the trincheras builders supported themselves by farming patches where flood waters could be spread over the fields. The trincheras were reserve villages for defense, and their distance from fields was no greater than that between the present fields and the foothill villages of the Papago Indians. The problem of water supply for the trincheras inhabitants is more difficult to solve than the food problem. Water must have been carried up from neighboring arroya seeps or wells, but it is difficult to conceive of enough water being on hand at any one time to withstand a protracted seige. Attacks must have been sporadic and acute rather than chronic.

A Geographer Looks at Politics

By GEORGE C. KIMBER
Instructor in Geography, Sacramento Junior College

Four main points were developed in this paper, namely:

1. Until political, social, racial, and economic differences subordinate themselves to geographic necessities, strength in any geographic unit is impossible.
2. At present, the subordination of political, social, racial, and economic differences to geographic necessity is haphazard and fortuitous.
3. Political decisions should be made in the light of hard facts which the geographer knows as a result of his investigation and scientific research, for these facts will eventually be a dominant force in the determining of public opinion.
4. The survival of democracy requires that scientific minds cooperate to devise techniques for ascertaining how and when adjustments in economic, social, and political life to geographic necessities may best be made.

As social, economic, and political adjustments to geographic necessities cannot be made faster than public opinion will permit, and as a scientific technique for determining the status of public opinion at any given moment is now available, the author advanced the suggestion that:

1. The Census Bureau set up machinery in one of its present divisions for polling the voters in each congressional district.
2. When any important political or controversial issue arises, any congressman may be empowered to request that the voters of his district be given necessary information and be polled on the issue or issues upon which he has to vote.
3. The poll ballots be distributed by frank through the post office and the signed but confidential ballots be returned by frank to the Census Bureau.
4. The Census Bureau tabulate the returns and break them down into significant groups and classifications, weighting these groups if necessary according to the best modern polling practices.
5. The results of such polls be made public.

The author asserted that such measures as the Ludlow Amendment for a national referendum on a question of war would be entirely unnecessary if such a poll were instituted without delay, and maintained that democracy would be immeasurably strengthened thereby.

Geographic Aspects of Land Use

By HELEN M. STRONG*

We have been accustomed to point to the geographic research and the consciousness of geographic factors existing among European geographers and others in Europe. Long ago these people became aware ot the land, the need to understand it, and the necessity for taking cognizance of such physical environmental elements as climate, soil, land form, native vegetation, native animal life, water and mineral resources, location and size of areas.

The United States has been passing through a similar experience. For three hundred years or more the American people have been spreading over the land, utilizing its resources. When America was settled, a wealth of land, forest and range, minerals, waterways, fertile soil lay almost untilled and practically unoccupied.

In the European countries from which came most of the pioneers and later settlers in the United States, areas were comparatively small, and climatic differences, though present, were not especially marked, except in the case of the Mediterranean regions as compared with those around the North Sea and English Channel. Farming practices and farm crops adapted to these regions had evolved and become established through centuries of development.

This situation provided little if any experience or understanding with which to meet to best advantage the land use opportunities presented here in America by an area as large as all of Europe, comprised of country-size regions, each characterized by distinctive soil, climate, land form, native vegetation, and water resource. For a time all went fairly well. The soil was so rich and filled with organic matter that it would produce under almost any method of tillage. Yields were high. Range grass, growing for centuries, afforded feed for livestock ready for the eating. If meat could not be shipped, hides were sent out as was done in the early days in California.

Within the Pacific Coast states is to be found as wide a range of differences between local regions as between any two larger regions in anv part of the country as a whole. These physical environmental conditions form the basic consideration in determining land use capabilities, although other economic and social fac tors also enter the land use picture. Serious problems confront every region on the Pacific Coast, because in many places land has been cultivated, grazed, or timbered with insufficient regard for its inherent capabilities.

Because the geographer is concerned with scientific field and laboratory study of these physical environmental, or land factors, such as soil, climate, land form, native vegetation, water and mineral resources, and with their separate and over-all relation to human activities, geographic science may render a significant contribution. Those professionally trained in geographic science may apply their technique to solution of many land use problems. Others who have studied geographic science as a part of their general training will sense the importance of land and of sound land use to all industry—manufacturing, agricultural, commercial, financial: in short—to all economic social activities and relaitons.

The geographer is analyzing and synthesizing physical environmental factors—the land and its resources, which compels him to think in overall concrete terms of the land and its capabilities. Consequently, problems of land use fall squarely into the field of geographic science.

*In Charge, Educational Relations, Division of Information, Soil Sonservation Service, Washington, D. C.

The Intensification of Agriculture in Sub-Tropical Japan

By MARGARET CARSTAIRS
University of Washington

For many years the Japanese have labored to maintain a high degree of self-sufficiency in the matter of food production. In spite of the handicaps of limited arable land and an increasing populatio they have been surprisingly successful. This has been accomplished by utilizing every natural advantage to the utmost.

As would be expected, the greatest success in high production per unit of land has been achieved in subtropical Japan where optimum conditions for agricultural production are found. In this part of Japan the climatic factors are favorable to continuous growth and the most extensive plains lie in this region.

Throughout the year most of the land is kept in production. Fall sown crops, such as barley, wheat, rape, and genge, mature by late May and early June. These are immediately replaced by rice in the lowlands and vegetables or grain on the upland plots. To save time in soil use rice is first planted in seed beds, where it grows for from thirty to fifty days on one-tenth of the area required for its later growth.

Constant, painstaking care is given to the growing crops. Weeding, irrigating, mulching, harvesting and refilling each small area as the crop matures keep the members of the farm household employed from dawn to dusk during the spring, summer, and autumn. The Japanese Department of Agriculture has found that the average Japanese adult farmer spends 200 days in actual agricultural work.

By careful tillage, improved cropping methods, and heavy use of fertilizers the Japanese farmers have been able to maintain intensive production over a long period of years.

The Susquehanna Corridor: A Neglected Trans-Appalachian Transportation Route *

By H. F. RAUP
University of California at Los Angeles

The North Branch of the Susquehanna River, between Wilkes-Barre on the south and Sayre on the north, has served as a secondary trans-Appalachian route, supplementing the routes by way of the Hudson-Mohawk corridor and the Cumberland Gap. Up and down this narrow valley have moved the Susquehannock Indians, the scout of Champlain, the Five Nations, and the men of General Sullivan's expedition of 1779. Later came the settlers from Connecticut who were in conflict with the Pennsylvania counties. This part of the Commonwealth of Pennsylvania therefore has a cultural background distinctly related to New England.

In more recent years, transportation in the North Branch corridor was provided by turnpikes, the North Branch Canal into New York State, the Lehigh Valley Railroad main line, and modern paved highways 6 and 220. It is upon this development of easy transportation that the principal land use of the area now depends, for northern Pennsylvania is a dairying region within the New York City hinterland. Without rapid rail and highway transportation it could not market its fluid milk. Transportation therefore becomes the principal basis of human activity and land use in this part of the Susquehanna Valley.

*This paper will appear in full in an early number of the Geographical Review.

Notes on Population Changes in the Coast Ranges of Northern California

By J. O. BROEK
University of California, Berkeley

In the Coast Ranges of Northern California population growth has been far from uniform. The valley lands have all increased, but since about 1900 many of the rugged portions have decreased or at least stagnated. This paper is a preliminary report on an investigation of this situation, and considers mainly Napa and Sonoma Counties, where most of the field work has been done.

Factors contributing to the emigration from the hill lands are:

1. The decline of the lumber industry, as in West Sonoma and South Mendocino Counties.
2. The decline of quicksilver mining in the Mount St. Helena area.
3. The relative decrease of economic opportunity in tne hill lands as compared to the rapid development of commercial agriculture in the lowlands.
4. The general rise in the standard of living, which is more and more difficult to realize. The small scale farmer, and especially the younger people are thus moving out.

These negative factors have been—at least partly—counterbalanced by other trends:

a. The increasing utilization of the hill lands as recreation areas, particularly in the southern part of the Coast Ranges, due to the proximity of the Bay Metropolitan Area.
b. The influx of retired people who have purchased homes in the hills.
c. The establishment of various kinds of institutions (schools, hospitals, Veteran's Home).

This development also has increased the sources of income for other population groups who supply food or perform services.

Associated with these changes is a remarkable age composition—a high concentration of the group 65 years and over, and a very small percentage of those 5 years and under (lower than the average for urban population in California).

Altogether, there is taking place a shift in the function of the mountains: primary production (agriculture, lumbering, mining) is being replaced by a secondary function, that of serving the lowlands and the Bay Metropolitan Area for recreation and residential settlement. Also, the ranges are becoming increasingly significant as watersheds for the lowlands. Reforestation and strict control of grazing are desirable as necessary adaptations of the hill lands to new conditions.

*This paper will appear in full in the Geographical Review.

The Landslide Near Sargent, California

By WALTER A. HACKER
San Francisco State College

Early in March this year there occurred a major mass-movement near Sargent, San Benito County, California. Due to its unusual size and its vicinity to a vital communivation line the feature received wide publicity as the "walking mountain of Gilroy." I visited the locality twice, in the comand of Edwin Thomas who recently finished a study on soil slips, and I am indebted to both of them for contribution of observations.

The mass-movement occurred on the north side of an isolated hill which separates the broad valley of the lower San Benito River in the South from the Santa Clara Valley in the North. On the San Bautista quadrangle of the Topographic Map this elevation is named "Lomerias Muer-

tas". It represents orographically a southeastern spur of the Santa Cruz Mountains which is separated from the main chain by the canyon of the Pajaro River. The highest elevation in the "Lomerias Muertas" is 1178 feet, a little more than 1000 feet above the floor of the Santa Clara Valley.

According to the recently published "Geologic Map of California 1:500.000" this isolated spur consists of Middle and Lower Pliocene marine sediments which in other localities are known as Fernando, Merced, San Diego, Wildcat series, Ferndale sandstone and others. In the "Lomerias Muertas" it is represented by soft and partly argillaceous sandstones which are interbedded with some layers of poorly cemented limestone conglomerates, thin layers of sandy shales, lenses of clay and thin seams of brown coal. The dip of the strata as it is exposed in the excavated "cirque" in the upper part of the slump is about 20° and towards S 30° E. Since a direct connection has been supposed, I should like to mention that the St. Andreas fault line is about 3 miles to the southwest of the landslide, and that no earthquake was recorded during the critical days close to the start of the movement.

The slope of the north side of the "Lomerias Muertas" is in general concave but almost the entire hillside shows the typical scarps and hummocks which are the scars left from former earth-movements. On the lower third of the hill, approximately between the 200 and 400 feet contour lines, the inclination of the slope is about 7°; the angle increases upward to 22° in the upper section underneath the general convexity of the crest region. The hillside is dissected by a few short, slightly incised canyons with intermittent creeks at the base of dale-like depressions. Frontal outcrops of more resistant layers are not conspicuous.

The south side of the "Lomerias Muertas" is also generally concave but less uniform. The surface is here composed of slope elements which quite obviously have the inclination of the dip and thus conform with the dorsal outcrops of more resistant strata. On this slope, too, scars of old slides can be recognized, but here the movement took place on the plane surfaces of the uniform dip as compared with slippages on the deep-seated curved surfaces of the opposite hillside.

The area under consideration is at the dry margin of the mediterranean climate region with low precipitation in winter and with dry summers. The nearest weather station is in Hollister, San Benito County, 8 miles to the southeast in the Santa Clara Valley. The average annual precipitation for Hollister over a 55 years period was 12.73 inches, with 11.31 inches or 87% falling during the winter season from November to April inclusive. Several years have been recorded with no rainfall from June, and even May, to September. Rainfall in 1938 was exceptionally high, 16.73 inches, i. e. about 33% higher than the average, but this was due to exceptionally frequent rains in February and March—a year before the landslide occurred—while the other months with two minor exceptions were under normal. Also under normal was the precipitation in the first nine weeks of 1939 preceding the start of the earth-movement.

Table I. shows the distribution of rainfall for the 14 months preceding the landslide at Hollister, San Benito County.

Table II. shows the distribution of rainfall at the same place for the first nine weeks of the year 1939.

No rains were recorded for the three weeks immediately preceding the start of the landslide. This hill, "Lomerias Muertas", is used as grazing land, bushes and groups of oak trees growing only in the wetter flattenings of old slip scars and in the canyons. The soil is dark grey-brown, about 2 to 3 feet thick at the crest, but thicker in the lower sections and often accumulated by soil slips. Only several outcrops on the south side are lacking a soil cover.

It was on the north side of the "Lomerias Muertas" where in the first days of March 1939 the landslide

Table 1. Rainfall at Hollister.

year	month	Precipitation, in inches			Number of days with precipit. 0.01 in. or more
		total	depart. from the normal	greatest in 24 hours	
1938	Jan.	2.41	— 0.36	0.61	7
	Febr.	4.88	+ 2.68	1.11	13
	March	4.67	+ 2.48	0.86	18
	April	1.53	+ 0.66	0.74	5
	May	0.01	— 0.48	0.01	1
	June	0.0	— 0.09	0.0	0
	July	0.0	— 0.04	0.0	0
	Aug.	0.0	— 0.01	0.0	0
	Sept.	0.15	— 0.11	0.08	3
	Oct.	0.81	+ 0.34	0.34	4
	Nov.	0.78	— 0.52	0.24	5
	Dec.	1.49	— 0.68	0.99	7
1939	Jan.	1.96	— 0.81	0.79	7
	Febr.	2.18	— 0.02	0.62	7

Table 2. Rainfall at Hollister January and February, 1939.

January							February						
3	5	6	21	28	30	31	1	3	4	7	8	10	11
0.08	0.79	0.44	0.01	0.20	0.39	0.23	0.32	0.58	0.35	0.07	0.62	0.12	0.12
Precipitation in inches													

occurred which is being discussed here. The movement started, according to local people, in the night of March 4, and was accompanied by a loud booming noise. It seems that the movement started below the crest near the saddle between B M 1137 and spot level 1178. From there the loose masses rushed downward, filling, overflowing, and transforming completely the dale-like depression which leads toward Sargent. Although the slide is plainly visible from the highway between Gilroy and Sargent, the movement went on unnoticed except locally for several days and no records regarding the amount of advance and the speed in the first days are available. There was some rainfall on March 7, (0.03 inches in Hollister), and again on the 10th and 11th (0.94 and 0.13 inches in Hollister). The added water content provided the rock masses with efficient lubrication and the slide resumed its advance. Now it was feared that the slide which then had assumed the type of an earthflow might reach and destroy the only power line which runs to the Salinas Valley along the foot of the hillside, or that it might even reach the channel of the Pajaro River, dam the then swollen river and destroy the bridge of the state highway at Sargent. This fear led finally to investigations by engineers of the State Highway Department and to the first reports in the newspapers. But with the stop of rainfall the movement of the slide came to a standstill. By the 12th the slide was advancing so slowly that the motion could hardly be noted by the human eye. The speed at that time had been estimated about four inches an hour. During the following days the slide advanced very little, covering only a few yards more until March 15, when the movement came apparently to a complete standstill, at least for the time being. The role played by the topography of the lower hillside in checking the flow will be discussed later. With the upper end of the ultimate slide cirque reaching over the crest line and the tongue of the connected secondary slump stopping about 800 yards from the highway bridge at Sargent, the slide attained a length of about a mile and in its middle section a width of about 250 yards and occupied, including the secondary slump, about 150 acres. No human life was lost, but range riders claimed the loss of some cattle which were trapped in the landslide.

The area remodelled by the earthmovement displays a variety of surface form elements, some of which, throw some light into the mechanism of the mass-movement, because they are distinctly linked with certain sections. The similarily between several of these features and those resulting

Fig. 1. Air view of the landslide in the "Lomerias Muertas" near Sargent, San Benito County, California. In front and the right middle ground is the secondary slump. (Photo: Clyde H. Sunderland, Oakland.)

Fig. 2. Section of the scarp of the main "slide-cirque." (Photo by W. Hacker.)

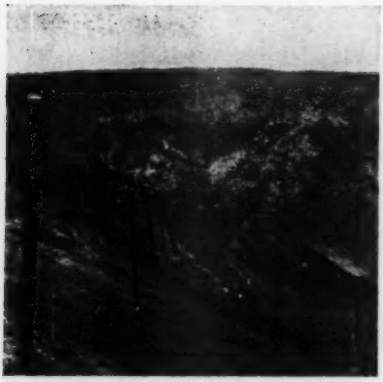

Fig. 3. View along the crest with the fence marking the position of the former water divide, the main "slide cirque" to the right. (Photo: W. Hacker.)

Fig. 4. Slickensides on the eastern side of the upper part of the landslide trough. (Photo: W. Hacker.)

Fig. 5. View along an inner debris ridge on the eastern side. (Photo: W. Hacker.)

Fig. 6. View along an inner debris ridge on the eastern side. (Photo: W. Hacker.)

Fig. 7. Slickenside on an almost vertical inward side of an inner debris ridge with well developed striae. (Photo: W. Hacker.)

Fig. 8. Bulging and crevassing in front of the outer debris ridge of the west side. (Photo: W. Hacker.)

from the activity of glaciers is surprising. A scrutiny of these form elements reveals that the area affected is not one single landslide but is composed of two major units of different age and character. These two units are: (1) the recent landslide which started to move in the first days of March; and (2) the lower sections of an older landslide which blocked the advance of the first and were themselves revived under the impact of the first in the flank.

The recent landslide comprises three well defined sections: (a) a deep primary and a smaller secondary depression in the upper region; (b) the area affected by the passing of the sliding rock masses in the middle part; and (c) the settled rock masses in the lower section.

Section (a) represents the area where the mass-movement started. Here not only parts of the regolith but also great masses of the poorly consolidated bedrock slipped on a deep-reaching concave slip-surface, broke to pieces and rushed downward. An inspection of some of the material left behind shows that the movement was of the dry type. It also must have been rather fast since it did not produce those more or less backward tilted step-like blocks settling upon the slip-surface which are so typical for the slower slump type of mass-movement, but, on the contrary, formed a deep excavation with the slip-surface widely exposed. In S. Sharpe's* terminology the mass-movement was therefore of the type of a rockslide. The deepest depression in the whole excavated section is found where the concave hillside possesses its steepest inclination just underneath the general convexity of the crest region. The almost level bottom of the excavation is about 200 feet below the edge of the undisturbed land on its sides. It is surrounded on three sides by concave cliffs, sections of the slip-surface, which are quite steep in the upper part and in some places almost vertical. Yet the present cliffs are not necessarily those formed by the initial slide but might be the result of secondary movements: sections of the hillside adjoining the original excavation were deprived of their support and slipped downward. The rock debris which is now partly covering the bottom of the depression might partly originate from such broken-down sections. Because of its resemblance to a glacial cirque, "slide-cirque" might be an appropriate term for this upper section of a landslide, the German equivalent of which is "Abrissgebiet."

I assume that it was here that the initial movement started and not in a second and somewhat smaller cirque above and in direct continuation of the first. I consider this second "cirque" as the product of a secondary slide, because it seems to me difficult to assume that the first impulse for the mass-movement should have come from this section which is already in the convex sector of the crest. This tributary cirque not only reaches the crest but extends even over it into the opposite hill-side. A barbed wire fence with its wooden poles now hanging in the air across the cirque marks the position of the former crest line. This section could slide down only after it had been deprived of its support by the first slide. Only a narrow strip of undisturbed land separates this upper cirque from an excavation of a bedding-plane rockslide on the southern hill-side which, according to information from local people, was formed in spring 1938. Continued recession of the rear cliffs of the two excavations will unite them some day and produce a deep cut across the crest.

Under the pressure of the sliding rock masses, either the primary body or secondary blocks, the slip-surface was smoothed, especially in the flatter lower sections, and in some instances the shearing produced true slickensides. Both clayey material and sand beds of high clay content were thus affected. The occurrence of these partly well polished and light reflect-

*C. F. Stewart Sharpe: Landslides and Related Phenomena. New York, 1938. 1938.

ing slickensides was probably the reason why the existence of a tilted clay layer was presumed upon which the rock masses should have slipped down. Against this must be held that, as stated earlier, the dip of the strata is in an opposite direction, into the mountain. These slickensides did not develop on bedding planes and they do not reveal clay beds, nor are they, on the other hand, limited to the outcrop of clays or clayey layers. It is simply that clay or clayey matter which was available at the slip-surface acted as a lubricant and stuck as a thin coat to the surfaces along which shearing took place. They are found not only over parts of the slip-surface but their counterparts and other unconnected slickensides appear also on the surfaces of larger coherent blocks. Becoming dry on the air the clayey coats crack and splinter off and reveals underneath the unaffected bedrock of a different composition. Similar slickensides are also found on the lateral debris ridges in the next lower section and will be described later.

The middle section (b) of the landslide, the "Sturzbahn" or landslide track, is the largest in area and accounts for about two thirds of its entire length. Also this section represents a depression in the present topography, although, due to filling up, the actual elevation of the lower part is higher than it was before the slide occurred. This area had been excavated and remodelled into a broad flat trough by the downward sliding rock masses. A steadily increasing amount of material has been left behind in the track in irregular heaps and ridges and has filled up the trough until at the lower end of this section it now reaches the brinks of the confining side cliffs. The accumulated material is broken down to a mixture of medium sized boulders, smaller fragments and sand and is very dry. No larger coherent clods or sheets of sod have been preserved. Large dead oak trees torn from their roots and splintered to pieces are a sign of the great turbulence of the movement.

A distinct feature of this middle section of the landslide, missing in the slide-cirque as well as in the next lower section, are the sets of parallel ridges along both sides of the track. These ridges are built of rock debris with "hochkant" set boulders like those in lateral glacial moraines. The outer ridge on each side is the highest and rests upon undislocated land. These ridges run through this whole section. Towards the middle they are accompanied by sections of parallel ridges of the same type. They are especially well developed on the eastern side of the landslide, where in one locality a set of five parallel ridges can be seen. The relative elevation of the ridges varies, in some instances they are more than 20 feet high. The ridges have generally a gentler slope on the outer side than on the inner, where they are sometimes almost vertical and have developed slickensides. In several of these slickensides perfect striae were found. It is an interesting fact that these slickensides have not only been formed upon the outcrop of bedrock and on the surfaces of large coherent blocks but even upon packed and compressed rock debris masses. It is obvious that these ridges have been formed by the passage of downhill sliding rock masses. They indicate thus clearly that the initial movement cannot have started in this section but higher up. They are the product of an overflow of material that can have come only from above. Such marginal debris ridges are necessarily absent along the brinks of the slide-cirque as well as in the next lower section, where the landslide spread as a whole over the adjoining hillside, and represent therefore a good "zone feature" for the landslide track. The existence of sets of parallel debris ridges indicates furthermore that the movement did not take place in one single rush but rather in successive flows of diminishing volume, each passing flow crest leaving new debris ridges behind and forming new sets of slickensides.

The hillside adjoining the landslide track was not left entirely unaffected by the earth-movement. In several

places the land in front of the outer debris ridges was warped and bulged, and fissures, several feet deep and more or less parellel to the ridges, were formed.

Landslide "tongue" might be the appropriate term for the next lower section (c). While some of the rock masses settled down already in the landslide track, it is here, generally speaking, that the amount of accumulated material exceeds the amount of erosion by the landslide. The rock masss, therefore, low over the sides of the landslide trough and spread over the adjacent area like the ice in the tongue of a glacier, provided that the surface configuration permits it. With the decrease in thickness of the landslide and frequently also in inclination of the underground a level is finally reached where the momentum is used up and the movement comes to a halt.

In our specific case, however, the movement was blocked before this natural level was reached by the swelling ground near the mouth of the canyon. The momentum was already too small to overcome this obstacle and the rock masses were dammed behind it instead of spreading out.

This swelling ground in front of the landslide is nothing else than the settled rock masses of another, older landslide which had lost its tongue-like shape and had acquired a soil and vegetation cover. These earth masses were not yet consolidated enough to remain unaffected by the impact of the recent landslide. A secondary mass-movement (2) occurred here which involved about 30 acres of land. The movement in this second unit was of a different type than in the primary rockslide. First, it did not start from the head and not by itself but was released from below, the upper section moving only after it had been deprived of its support. Then, the movement was much slower and the horizontal dislocation far less than in tthe first unit. The estimates of speed, mentioned above, refer to this secondary slump. Furthermore, the movement was not so deep-reaching in the upper and middle section although it was also not limited to the soil horizons but included portions of the bedrock. The spoon-shaped slip-surface was only in a few instances exposed and no slide-cirque or slide-trough was formed. Very little turbulence was involved in the process, the motion was more a true sliding. The disturbed area was dissected by a great number of mostly transverse fissures, but as a rule, the blocks thus formed were not turned over and the soil and vegetation cover remained widely intact. Only in a few places were parts of the sliding mass completely disrupted. This second unit can, therefore, be well separated from the first, where the rock masses are completly broken to pieces and the trees uprooted and overturned; the part immediately adjoining the primary landslide was buried under the crumbling rock masses. The greatest disturbance occurred at the lower end which was bulged and badly crevassed and where segments turned over and crumbled over the foreland. In the middle and upper sections the segments between the transverse fissures show very well the typical backward rotation on more or less horizontal axes and the steplike character related with it. The whole upper section moved only for a few yards and sunk several feet. It is surrounded by a continuous, deep marginal crevasse. These features and the fact that no excessive moistening was involved put this secondary mass-movement in the class of rock slumps, released by removal of support underneath.

Discussing, finally, what might have released the primary mass-movement, I think we can leave out of consideration some quite fantastic explanations of local people. But there is also no evidence for other hypotheses which have been advanced. No earthquakes were recorded in this area immediately preceding the movement and no disturbance on the San Andreas fault line. There were also no heavy rainfalls during the previous days. As a matter of fact, no rains

fell during three and a half weeks before March 4, and the precipitation during the whole winter season was only 83% of the normal. There was also no immediately preceding undercutting on the slope, besides the fact that this would result in a different type of mass-movement. There is also no evidence for "overloading", besides that overloading can not release a mass-movement by itself, but only when it brings about a reduction of friction.* But I think also, that there is no need for any specific impulse; this landslide like many others, the scars of which are so conspicuous over the whole "Lomerias Muertas", is a denudation phenomenon entirely appropriate to the type of bedrock, the inclination of the hillsides and the climatic condition. Furthermore, every mass-movement results in oversteepening the slope and invites successive movements. It is only natural that movements of a larger scale will occur less frequently than such of smaller size. After loosing support from below by removal of material, an upper zone was liable to slip probably for quite a time. It was kept in place by the coherence of the material. The particular dip of the strata might have, to some degree, both, delayed the occurrence and shifted the slip-surface downward. With a dip smaller than the slope of the hill in the same direction a mass-movement would have taken place some time ago, when the strain was still less, and would have involved a smaller volume of rock masses. If in all that time no movement occurred, it must have been due to the fact that the unstable surface zone was too well anchored in the underground. But, either because the cohesion of the rock decreases downward for some distance or because the coefficient of friction decreases in the same direction, or due to a combined action of both of these factors, a condition must be reached in a certain deph, where the downward pull becomes greater than the cohesion. This would represent a point of the slip-surface. For the existence of such a struggle between different forces speaks the nature and shape of the slip-surface which is neither a bedding-or joint-or fault-plane but a concave surface. It needs time to make the increase of the downward pull effective and to produce thereafter a decrease of cohesion and of the coefficient of friction. One should, therefore, not expect to find for a mass-movement of that type an immediately preceeding, visible impulse. Considering the softness of the bed-rock which builds up the "Lomerias Muertas" it is the fact that the hill still exists as such a pronounced elevation that surprises, rather than the occasional occurrence of landslides on its slopes.

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*S. Sharpe's class "II B" (op. cit. p. 85) can not be justified; the processes mentioned there should be dealt with under class "C" as possible causes for reduction of friction. This misconcept is probably based upon a statement in W. Penck's "Morphologische Analyse" as will be shown in another article.

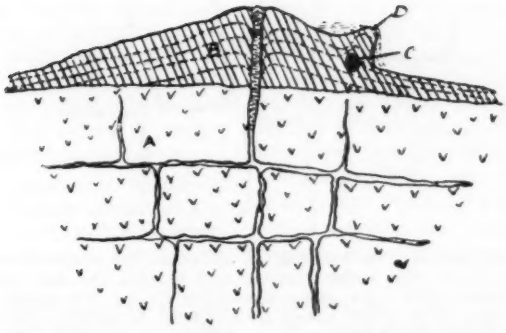

Figure 1. A giagramatic cross section of a hot spring, showing the development of a terrace. (A) Rhyolite. (B) Sinter. (C) Obstruction such as a pebble or a twig. (D) The locus of most rapid deposition coincides with the line of greatest evaporation, where the surface of the water has a decided convex curve. In the case of travertine springs increased loss of gas at this position is an additional cause of deposition.

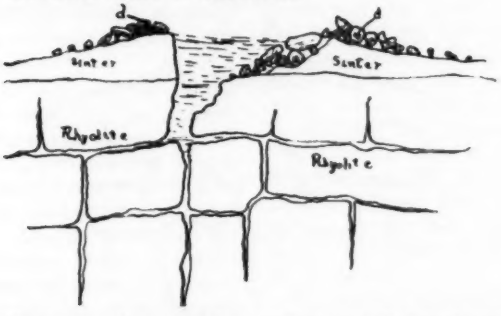

Figure 2. An explosion crater caused by steam. (d) indicates debris thrown out by the explosion. This may happen to a hot spring such as that one shown in Figure 1.

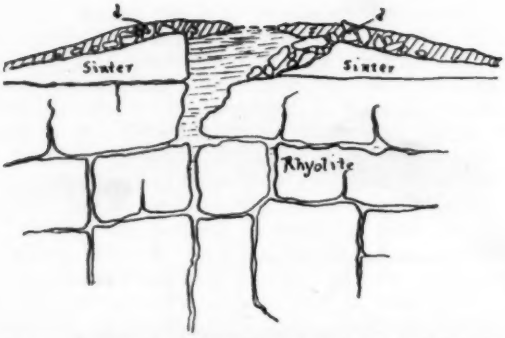

Figure 3. The building of sinter at the water line reduces the water surface and retards the loss of heat. This may cause a surging in the hot spring and later bring about intermittent eruptions. (S) sinter, (d) debris.

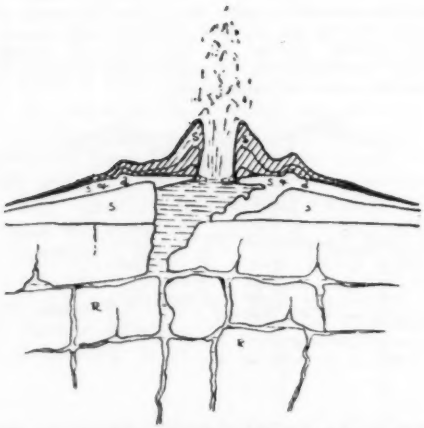

Figure 4. Spray and splash will develop the cone or elevated portion about the orifice. If the eruptions are violent they may cause more erosion than deposition; however, deposits will be formed by the spray and splash during the so-called quiet intervals. (R) Rhyolite, (s) sinter, (s) & (d) sinter and debris.

Old Faithful,
An Example of Geyser Development in Yellowstone Park*

By CLYDE MAX BAUER** and GEORGE MARLER***

Undoubtedly the best known geyser in the world is Old Faithful in the Upper Geyser Basin of Yellowstone National Park. The name itself is appealing and suggests regularity and unchangeableness. Visitors usually ask first, "When does it spout?" second, "How high does it go?" third, "How old is Old Faithful, anyway?" This article is presented in an attempt to answer these questions and others of similar nature on this most famous geyser.

Wherever the subject is introduced the geology and the mechanism of geysers seems to be fairly well understood. The fact that hot springs and geysers deposit white earth and mineral around their openings is also well known. Why these deposits are terraces in some places, mounds other places and in still others are cones of symmetrical or unsymmetrical outline, is not so well known. The writers believe there are essential differences between the formation of a terrace, a mound and a cone. But before discussing the deposits of Old Faithful Geyser in detail we will try to answer the first two questions given above.

With regard to the eruption of Old Faithful Geyser there has been considerable misunderstanding among visitors about its interval, duration and height. Some think it plays every hour and on the hour, but of course this has never been the case. Studies made by the Carnegie Institution[1] have dispelled much of the misinformation on geysers, but an attempt will be made here to give correct data on this famous geyser so far as it is in our possession at this time.

A daylight record made during the summer of 1938, between June 15 and September 1 by Ranger Naturalist H. R. Woodward and associates included the recording by use of an ordinary eight-day clock the time elapsed between the high point of one eruption to the high point of the next for 927 eruptions. This data gives the average interval as 66.54 minutes or 66 min. 32 sec. The variations in length of interval observed have run from 34 minutes to a maximum interval of 115 minutes though by far the larger number of periods are very near the average length of 66½ minutes. The duration of the main eruption will run from 2 to 5 minutes and usually there are several preliminary spurts in which the water column will rise from a few feet to ten or fifteen feet. As many as 19 preliminary spurts have been counted though only two or three are commonly noted.

The height of the water column during the main eruption has been measured with a transit, on a number of occasions, and found to vary considerably. The figures run from 116 feet to 171 feet and the average height is usually given as 150 feet, though an insufficient number of measurements have been made to give any reliable figure on the average height. Measurements made in 1870,[2] '71 and '72' indicate a height of from 106 to 130 feet. It appears that the height and activity of Old Faithful are very nearly the same as they were when observed by the discovery party in 1870, or 68 years ago.

The amount of water thrown out at an eruption was estimated in 1930 by Drs. Allen and Day of the Carnegie Institution, op. cit., at 10,000 to 12,000 gallons, though this figure is based on run-off and does not take into account the water which goes into the air as vapor.

Two minerals are commonly deposited about hot springs and geysers, travertine and silica. Travertine is soft and not given to forming geyser cones, whereas silica is hard and found practically everywhere geysers are found, although not absolutely essential to

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** Park Naturalist, Yellowstone National Park.

*** Ranger Naturalist, Yellowstone National Park.

them. The hot water issuing from the ground may be saturated with one, or the other, or both. Furthermore, suspended silica is abundant in some of the springs. In general, the movement of hot water from springs and geysers results in the growth of the surface over which it flows causing an elevation known as a mound, group of terraces or a cone. But both erosion and deposition proceed together, with deposition being in the ascendancy only where the water is not too swift. As the water is poured out of the spring it may flow gently or swiftly. In eather case it loses heat, and gas, because of loss of pressure, and by evaporation the volume of water is reduced so that the mineral in the solution is in part precipitated. The splash from the water or even vapor may be very effective in bringing about deposition. These actions aid evaporation and wherever evaporation is, deposition is likewise rapid. A pebble, a twig, or a leaf will produce a ripple and this will increase precipitation. Wherever the curvature of the water surface is bent sharply upward or outward evaporation is increased and deposition is accentuated (see Figure 1). Hence, terraces are the natural result of gently flowing water where ripples develop, and small terraces coalesce into larger ones. In reality the small terraces thus former are most likely to be flat rimmed basins, at least in infancy, and later the "pulpit" terrace develops. After these coalesce the water is spread more widely and thinly than before with the result that a broad terrace is built. The level rim is maintained by the water level. If at any time a part of the rim becomes too high deposition is slowed up for lack of sufficient water and conversely if the rim is too low additional water, if not too rapid, will increase precipitation and hence a balance is maintained. Recurrent surges from the open pool or fountain type geyser may develop terraces in much the same way.

Mounds result from a somewhat different process, although many mounds have terraces built around them. The most common type of mound is built by a combination of basin, splash, vapor and rivulet deposits. The rivulet erodes on the bottom of the channel and deposits at the edges. After a time the edges extend over the surface of the rivulet and gradually stop the flow which then overflows in a new place starting a new rivulet at a slightly higher point. Many springs thus have two, three or more overflow channels. This spreading of the flow increases evaporation and accordingly deposition. The mound is a result of all the activities of a hot spring or geyser and not of any simple process. The part played by the splash, spray and vapor is extremely important. It is by this means that the saturated water is spread most thinly over solid materials and is therefore evaporated most rapidly. Only the freezing of the water can cause more rapid precipitation than constant splashing.

At this point it may be well to call attention to the character of many of the streams draining geyser basins. They have the character of distributaries found on the flood plains and deltas of large and sluggish rivers, where deposition exceeds erosion. A few examples such as Tantalus, Tangled, White and Rabbit Creeks serve to illustrate the type of braided stream channels where deposition is exceeding erosion. Their drainage basins are gradually being filled with sinter.

Where geyser action or intermittent spouting is predominant different deposits are the result. Cones, pillars, and various vertical forms are evident. Monument Geyser Basin presents some excellent examples of pillars or chimneys built under the influence of a more or less constant spray.

Thus it becomes evident that the character and structure of a deposit reveals the kind of activity which has produced it.

Where tremendous volumes of water are thrown out with an eruption we can look for erosion instead of deposition. This is the case around the cone of the Giant Geyser particularly along the south side where a deep gully is now being carved. It is also true on the northeast flank of Old Faithful where the prevailing southwest winds cause a

great fall of water. Here erosion has cut a ravine four feet deep into the edge of the mound of a former hot spring. Erosion is also uncovering the stumps, roots and trunks of trees which grew on Old Faithful's own cone not so very long ago. The prevailing direction of the wind being from the southwest causes a great fall of water on the northeast flank, so here erosion is exceeding deposition.

The fact that about one-third of Old Faithful's cone is now being eroded suggested to the writers that a different form of activity has given rise to the main structure than that which is going on today. If we grant that the character of the hot spring or geyser activity determines the form and structure of the deposit which results therefrom, there is a definite suggestion that the water from Old Faithful's orifice has been, up to a few hundred years ago, that of a quietly flowing hot spring or at best of the fountain type geyser such as is displayed at Great Fountain.

Terraces are plainly visible on the sides of Old Faithful's cone up to within two or three feet of its very top. Furthermore, the thickness of sinter such as would result from geyser activity—splashing, spray and vapor—is a mere shell of a few inches to a maximum of ten inches in thickness. As a geyser, then, Old Faithful is only a few hundred years old.

In regard to the presence of partially petrified wood in the form of stumps, roots and trunks of trees on the mound of Old Faithful we find no less than 40 stumps and 60 sections of trees now exposed within 125 feet of the orifice and at least two of these stumps are right at the summit. The protuberances at the northwest of the vent have long been considered as the usual structural prominences built up by geyser activity. Close inspection shows that these lumps are merely tree stumps covered with a alyer of geyserite eight to ten inches thick. Therefore, there was a quiescent period prior to the present activity which permitted the growth of trees up to 15 inches in diameter at all points on the mound even up to its apex. From the size and number of the trees present the inactive period must also have been several hundred years in length.

Thin sections of the partially petrified wood were reported by Professor E. A. Longyear of Colorado State College to be of Lodgepole pine (Pinus contorta).

The presence of lodgepole pines on the mound indicates that Old Faithful was a long time as inactive as any of the seven neighboring cones which now lie dormant in the immediate vicinity. The factors that brought about this complete cessation of thermal activity in Old Faithful are rather difficult to ascertain. That the early activity varied between hot springs and fountain type eruption is quite certain from the structure of the mound as now exposed on its partially eroded side.

The usual evolution of a geyser from a hot spring as pointed out by Allen and Day is brought about somewhat as shown in the diagrams, Figures 2, 3 and 4. First, water flows from a simple crack or crevice. As the adjacent rock is disintegrated by the heat and gases, caving takes place. If the current is strong enough some of this is washed away. The residue of the material thus formed may choke or partially obstruct the circulating water. If sufficient steam is available a preliminary explosion may occur which will produce a crater or open well. Dissolving of silica at some depth will widen the crevices and develop caverns. If the flow of water still remains fairly constant, the crater or well of the spring will gradually close in at the top by deposition of sinter at the water line. After this has gone on for a time the partially covered well retards the loss of heat and again accumulated steam may cause an explosion in which part of the cover is removed, or a surging may set in which will cause a fountain type of geyser to develop as in the Sapphire Pool. As the mound builds higher and the shelf of sinter grows toward the center a sort of nozzle may be developed. Why there should be a total cessation of activity for a time is more obscure. Though it is most likely explained by

assuming a diversion of the hot gases supplying the heat or a choking of the channels of water supply, or both. Eventually these factors will cause the extinction of the hot spring or geyser.

The height and size of the mound of sinter on which Old Faithful sets indicates that thermal springs have been active in this place for a very long time. Estimates based on the thickness of silica exposed are not likely to represent the quiescent periods nor take into account the changes in rate of deposition. That thermal activity has been recurrently at work in this locality in excess of 10,000 years seems to be a safe guess. On the other hand Old Faithful as a geyser is a newcomer compared with Giant, Castle and Lion geysers.

From observations made in the summer of 1939 the authors tentatively conclude that the length of time between eruptions of Old Faithful is generally in direct proportion to the length of time that the preceding geyser eruption lasted.

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[1] Allen, E. T. and Day, A. L. "Hot Springs of the Yellowstone National Park." Carnegie Institution of Washington, 1935.

[2] Langford, N. P. "The Discovery of Yellowstone National Park." PP. 168-169, 1923.

[3] Peale, A. C. "The Thermal Springs of Yellowstone National Park," U. S. Geol. and Geog. Survey of the Territories, 1878, Part II. PP. 219 220

Errata

Page 38: For "communivation" in line five of Walter A. Hacker's paper read "communication." Following line eight in same paper add; "in company of John Leighly of the University of California."

Page 43: In line fourteen of fiirst column, for "masss" read "masses," and for "low" read "flow."
In fourth line from bottom of first column, for "tthe" read "the."

Page 44: In fifth line from bottom, first column, insert "and" after "hill."
In line eleven, second column, for "deph" read "depth."

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